Temperature Control Module

User's Manual

MITSUBISHI

Mitsubishi Programmable
Logic Controller

MELSEC-Q

Q64TCTT
Q64TCTTBW
Q64TCRT
Q64TCRTBW
GX Configurator-TC
(SW0D5C-QTCU-E)

• SAFETY PRECAUTIONS •

(Always read these instructions before using this equipment.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.
The instructions given in this manual are concerned with this product. For the safety instructions of the programmable controller system, please read the CPU module User's Manual.
In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".

⚠ DANGER	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Note that the ⚠CAUTION level may lead to a serious consequence according to the circumstances. Always follow the instructions of both levels because they are important to personal safety.

Please save this manual to make it accessible when required and always forward it to the end user.

[Design Precautions]

⚠ DANGER

- Do not write data into the "read-only area" in the buffer memory of the intelligent function module. In addition, do not turn on/off the "reserved" signals among the I/O signals transferred to/from the PLC CPU.
  Doing so can malfunction the PLC system.
- Depending on the malfunction of the external output transistor, there may be cases where the output is ON or OFF status. Install external monitoring circuitry for output signals that may lead to major accidents.

⚠ CAUTION

- Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
  They should be installed 100 mm(3.94 inch) or more from each other.
  Not doing so could result in noise that may cause malfunction.

[Installation Precautions]

⚠ CAUTION

- Use the PLC in an environment that meets the general specifications contained in the CPU User's Manual.
  Using this PLC in an environment outside the range of the general specifications may cause electric shock, fire, malfunction, and damage to or deterioration of the product.
- While pressing the installation lever located at the bottom of module, insert the module fixing tab into the fixing hole in the base unit until it stops. Then, securely mount the module with the fixing hole as a supporting point.
  Improper installation may result in malfunction, breakdown or the module coming loose and dropping. Securely fix the module with screws if it is subject to vibration during use.
- Tighten the screws within the range of specified torque.
  If the screws are loose, it may cause the module to fallout, short circuits, or malfunction.
  If the screws are tightened too much, it may cause damage to the screw and/or the module, resulting in fallout, short circuits or malfunction.
- Be sure to shut off all phases of the external power supply used by the system before mounting or removing the module.
  Not ding so may cause electric shock or damage to the module.
  In the system where a CPU module supporting the online module change is used and on the MELSECNET/H remote I/O stations, modules can be replaced online (during energizing).
  However, there are some restrictions on replaceable modules and the replacement procedures are predetermined for each module.
  For details, refer to the chapter of the online module change in this manual.
- Do not directly touch the conductive area or electronic components of the module.
  Doing so may cause malfunction or failure in the module.

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[Wiring Precautions]

⚠ CAUTION

- Be careful not to let foreign matters such as sawdust or wire chips get inside the module.
  They may cause fires, failure or malfunction.
- The top surface of the module is covered with protective film to prevent foreign objects such as cable offcuts from entering the module when wiring.
  Do not remove this film until the wiring is complete.
  Before operating the system, be sure to remove the film to provide adequate heat ventilation.
- Be sure to fix communication cables or power supply cables leading from the module by placing them in the duct or clamping them.
  Cables not placed in the duct or without clamping may hang or shift, allowing them to be accidentally pulled, which may cause a module malfunction and cable damage.
- Do not grab on the cable when removing the communication or power cable connected to the module.
  When disconnecting a cable without a connector, first loosen the screws on the part that is connected to the module.
  Pulling the cable when it is still connected to the module may cause damage to the module or cable, or misoperation due to cable contact failure.
- Always ground the shielded cable for the PLC.
  There is a risk of electric shock or malfunction.
- ·Use applicable solderless terminals and tighten them with the specified torque. If any solderless spade terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- When wiring, be sure to verify the rated voltage of the product as well as the terminal layout. Fire or failure may result if incorrect voltage is input or incorrect wiring is performed.
- Connecting terminals with incorrect voltage may result in malfunction or mechanical failure.

[Startup/Maintenance Precautions]

⚠ CAUTION
• Do not disassemble or modify the module. Doing so could cause failure, malfunction, injury or fire. • Be sure to shut off all phases of the external power supply used by the system before mounting or removing the module. Not doing so may cause failure or malfunction of the module. In the system where a CPU module supporting the online module change is used and on the MELSECNET/H remote I/O stations, modules can be replaced online (during energizing). However, there are some restrictions on replaceable modules and the replacement procedures are predetermined for each module. For details, refer to the chapter of the online module change in this manual. • Mounting/removing the module to/from the base and the terminal block is limited to 50 times after using a product. (IEC61131-2-compliant) Failure to do so may cause malfunctions. • Do not touch the connector while the power is on. Doing so may cause malfunction. • Switch all phases of the external power supply off when cleaning or retightening the terminal screws and module installation screws. Not doing so may cause failure or malfunction of the module. If the screws are loose, it may cause the module to fallout, short circuits, or malfunction. If the screws are tightened too much, it may cause damages to the screws and/or the module, resulting in the module falling out, short circuits or malfunction. • Always make sure to touch the grounded metal to discharge the electricity charged in the body, etc., before touching the module. Failure to do so may cause a failure or malfunctions of the module.

[Disposal Precautions]

⚠ CAUTION
• When disposing of the product, handle it as industrial waste.

REVISIONS

* The manual number is given on the bottom left of the back cover.

Print Date	* Manual Number	Revision
Oct., 2000	SH (NA)-080121-A	First edition
Jun., 2001	SH (NA)-080121-B	Standardize the name from software package (GPP function) to Product name (GX Developer). Standardize the name from utility package (QTCU) to Product name (GX Configurator-TC). Addition Section 1.4, Section 2.1, 2.2 Correction Conformation to the EMC Directive and Low Voltage Instruction, About the Generic Terms and Abbreviations, Product Structure, Section 3.5.47, Section 5.2, 5.2.1, 5.2.2, 5.3.3, 5.6
Feb., 2002	SH (NA)-080121-C	Add the contents of the function version C Addition Chapter 7 Renumbering Chapter 7 → Chapter 8 Correction SAFETY PRECAUTIONS, About the Generic Terms and Abbreviations, Section 2.1, 2.2, Section 3.1.1, 3.2, 3.2.1, 3.2.10, 3.2.11, 3.5.1, 3.5.11, 3.5.20, 3.5.32, 3.5.42, Section 4.3, Section 5.2.1, 5.2.2, Section 6.2.2, 6.3, Section 8.1
Aug., 2002	SH (NA)-080121-D	Correction Section 2.1, Section 3.1, 3.2.1, 3.2.7, 3.5.1, 3.5.12, 3.5.15, 3.5.20, 3.5.26, 3.5.34, 3.5.35, 3.5.44, 3.5.45, 3.5.49, 3.5.51, 3.5.52, Section 6.3, Section 8.10
Feb., 2003	SH (NA)-080121-E	Correction SAFETY PRECAUTIONS, INTRODUCTION, CONTENTS, Section 2.1, Section 3.1.1, Section 3.5.38, Section 5.2.2, Section 5.3.3, Section 5.4 to Section 5.6
May, 2003	SH (NA)-080121-F	Correction Section 2.1, Section 3.5.15, Section 3.5.36, Section 6.3
May, 2004	SH (NA)-080121-G	Addition of program example for use on the remote I/O network Correction Section 2.1, 2.2, Section 3.5.4, Chapter 6, Section 7.1, 7.3.1, 7.3.2
Oct., 2004	SH (NA)-080121-H	Correction SAFETY PRECAUTIONS, Section 2.1, Section 3.1.1, 3.2.1, Section 4.1, Section 6.3, 6.3.1, Section 8.1

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Print Date	* Manual Number	Revision
Jul., 2005	SH (NA)-080121-I	Correction SAFETY PRECAUTIONS, Conformation to the EMC Directive and Low Voltage Instruction, Section 1.3.4, Section 2.1, 2.2, Section 3.1.1, 3.2.11, 3.4.3, 3.5.2, 3.5.8, Section 4.5, Section 5.1, 5.2.1, 5.3.2, 5.3.3, 5.4, 5.5, 5.6, Section 6.2, 6.2.1, 6.3, 6.3.1, Section 7.2, 7.3.1, 7.3.2, Section 8.10
Mar., 2006	SH(NA)-080121-J	Correction SAFETY PRECAUTIONS, Conformation to the EMC Directive and Low Voltage Instruction, Section 3.5.26

Japanese Manual Version SH-080108-L

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INTRODUCTION

Thank you for the purchasing the MELSEC-Q series PLC.
Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the Q series PLC you have purchased, so as to ensure correct use.

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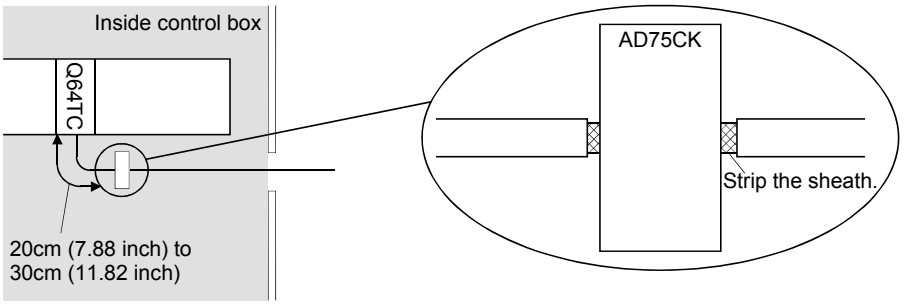
Conformance with the EMC and Low Voltage Directives

When incorporating a Mitsubishi PLC that is compliant with the EMC and low voltage directives into any other product and ensuring compliance with these directives, refer to Chapter 3 “EMC and Low Voltage Directives” of the User's Manual (Hardware) for the PLC CPU included with the CPU module or base unit.
The CE logo is printed on the rating plate on the main body of the PLC that conforms to the EMC directive and low voltage instruction.

The following wiring is required for conformance of this product with the EMC Directive and Low Voltage Directive.

(1) Use shielded cables for all external wiring and use the AD75CK cable clamp to ground this product to an enclosure.



(2) Using the AD75CK, you can tie four cables of about 7mm outside diameter together for grounding.

(3) The following number of AD75CKs will be needed.
(Assuming that 7mm-diameter cables are used for all wiring)

Number of AD75CKs needed		Number of channels used			
		1	2	3	4
Number of CT channels used	0	1	1	2	2
	1	1	2	2	3
	2	1	2	2	3
	3	2	2	3	3
	4	2	2	3	3
	5	2	3	3	4
	6	2	3	3	4
	7	3	3	4	4
	8	3	3	4	4

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About the Generic Terms and Abbreviations

Unless otherwise specified, this manual uses the following generic terms and abbreviations to describe the Temperature control module.

Generic term/abbreviation	Description
Personal computer	DOS/V-compatible personal computer of IBM PC/AT® or its compatible
GX Developer	Generic product name of the product types SWnD5C-GPPW-E, SWnD5C-GPPW-EA, SWnD5C-GPPW-EV and SWnD5C-GPPW-EVA. "n" in the model name is 4 or greater.
QCPU (Q mode)	Generic term of the Q00JCPU, Q00CPU, Q01CPU, Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU, Q12PHCPU and Q25PHCPU.
QnPHCPU	Generic term of the Q12PHCPU and Q25PHCPU.
GX Configurator-TC	Generic term of temperature control module setting/monitoring tool GX Configurator-TC(SW0D5C-QTCU-E)
Q64TCTT	Abbreviation of Type Q64TCTT temperature control module
Q64TCTTBW	Abbreviation of Type Q64TCTTBW temperature control module with disconnection detection function
Q64TCRT	Abbreviation of Type Q64TCRT temperature control module
Q64TCRTBW	Abbreviation of Type Q64TCRTBW temperature control module with disconnection detection function
Q64TC	Generic term of Type Q64TCTT, Q64TCTTBW, Q64TCRT and Q64TCRTBW

Product Structure

The product structure of the product is given in the table below.

Model code	Product name	Quantity
Q64TCTT	Type Q64TCTT temperature control module	1
Q64TCTTBW	Type Q64TCTTBW temperature control module with disconnection detection function	1
Q64TCRT	Type Q64TCRT temperature control module	1
Q64TCRTBW	Type Q64TCRTBW temperature control module with disconnection detection function	1
SW0D5C-QTCU-E	GX Configurator-TC Version 1 (1-license product) (CD-ROM)	1
SW0D5C-QTCU-EA	GX Configurator-TC Version 1 (Multiple-license product) (CD-ROM)	1

1 GENERAL DESCRIPTION

This manual deals with the specifications, handling and instructions wiring and programming methods of the following temperature control modules used with the MELSEC-Q series PLC CPU module (hereafter abbreviated to the PLC CPU).

- Type Q64TCTT temperature control module
- Type Q64TCRT temperature control module
- Type Q64TCTTBW temperature control module with disconnection detection function
- Type Q64TCRTBW temperature control module with disconnection detection function

(1) What are Q64TCTT and Q64TCRT?

(a) The Q64TCTT and Q64TCRT are modules designed to convert input values from external temperature sensors into 16-bit signed BIN (binary) data, perform PID operations to attain target temperatures, and provide transistor outputs for temperature control.

(b) The Q64TCTT and Q64TCRT have an auto tuning function which automatically sets the proportional band (P), integral time (I) and derivative time (D) for PID operations.

(c) The Q64TCTT accepts K, J, T, B, S, E, R, N, U, L, PL II and W5Re/W26Re type thermocouples. The Q64TCRT accepts Pt100 and JPt100 type platinum temperature-measuring resistors.

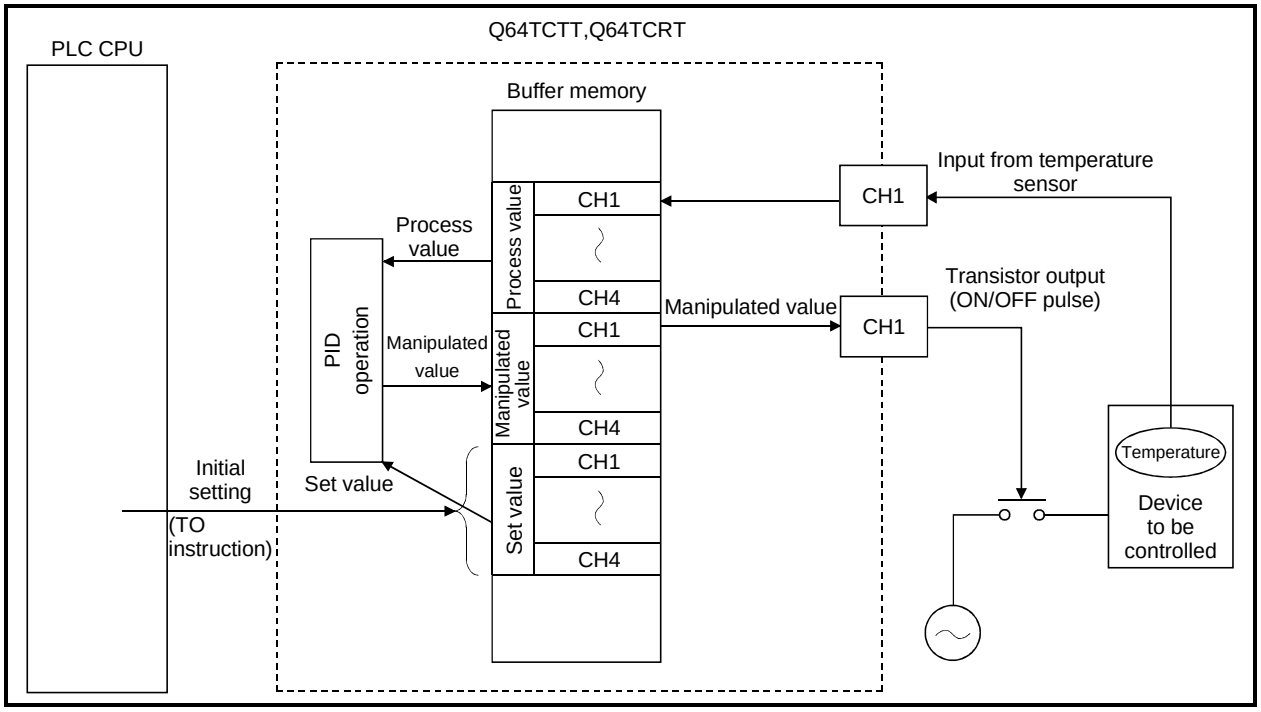


Fig. 1.1 Q64TCTT or Q64TCRT Processing Outline

REMARK

1) Refer to Section 3.2.1 for the auto tuning function
2) Refer to Section 3.1.2 for the measured temperature ranges of the temperature sensors that can be connected to the Q64TC.

1

(2) What are Q64TCTTBW and Q64TCRTBW?

The Q64TCTTBW and Q64TCRTBW are Q64TCTT and Q64TCRT-based modules which have the additional function to detect a heater wire disconnection using inputs from external current sensors.

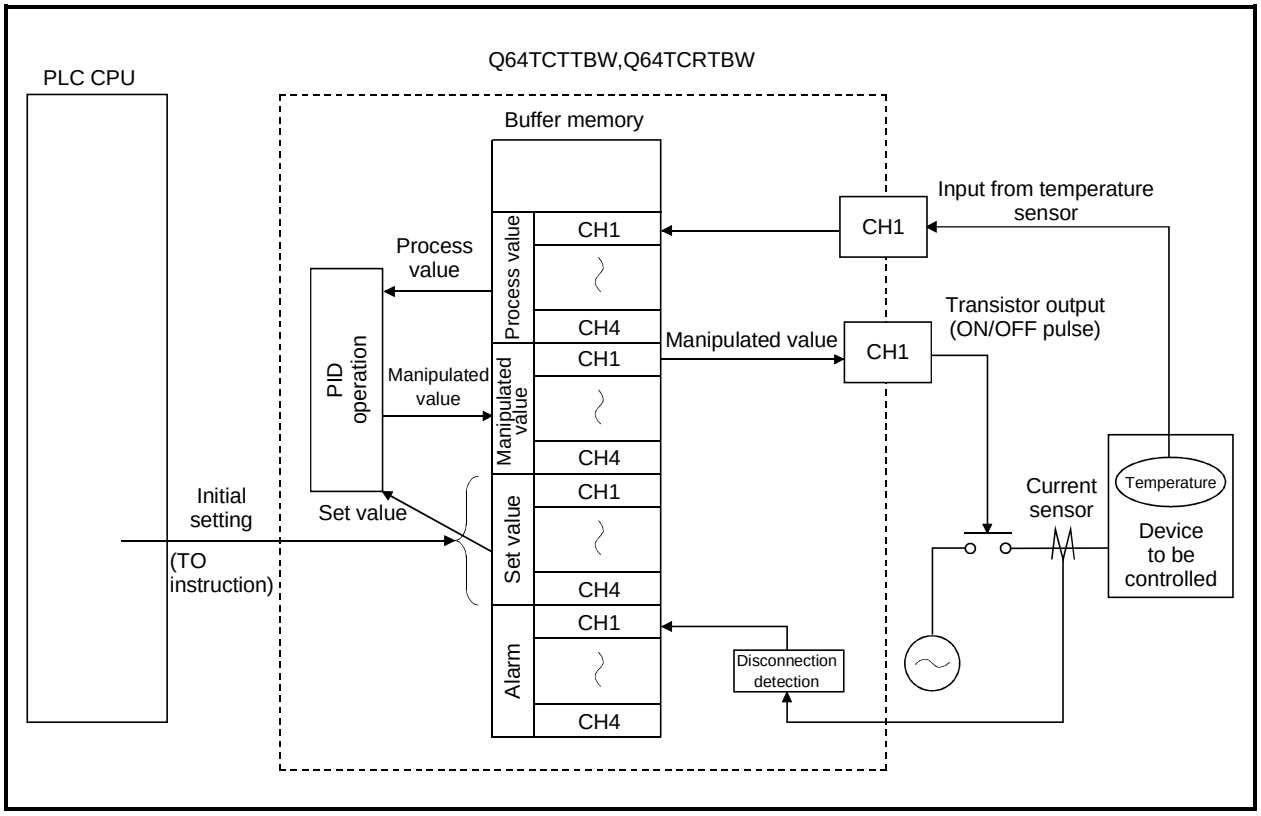


Fig. 1.2 Q64TCTTBW or Q64TCRTBW Processing Outline

REMARK

1) Refer to Section 3.2.7 for the disconnection detection function of the Q64TCTTBW and Q64TCRTBW.

1.1 Features

The Q64TC has the following features.

(1) Optimum temperature adjustment control (PID control)

(a) The Q64TC exercises temperature adjustment control automatically by merely setting the PID constants (proportional band (P), integral time (I), derivative time (D)) and temperature set value (set value: SV) necessary for PID operations.
Therefore, no special instructions are needed to perform PID control.

(b) Using the auto tuning function enables the PID constants to be set automatically by the Q64TC.
Hence, you can use the equipment without being conscious of cumbersome PID operation expressions to find the PID constants.

(2) 4 loops on 1 module

The module provides a maximum of four loops at the same time for temperature adjustment control.

(3) RFB limiter function

The RFB (Reset FeedBack) limiter suppresses overshooting which is liable to occur at a startup or when a temperature set value (SV) is increased.

(4) Sensor compensation function

By setting a sensor compensation value, the sensor compensation function eliminates a difference between a temperature process value (PV) and an actual temperature, if any.

(5) Connection of thermocouples compatible with JIS, IEC, NBS, ASTM and DIN Standards

(a) The Q64TCTT(BW) accepts the following thermocouples compatible with the JIS, IEC, NBS, ASTM and DIN Standards.

- JIS Standards : R, K, J, S, B, E, T
- IEC Standards: R, K, J, S, B, E, T, N
- NBS Standards : PL II
- ASTM Standards: W5re, W23re
- DIN Standards : U, L

(b) The Q64TCTT(BW) allows you to set the temperature measurement ranges which meet the operating temperatures of the above thermocouples.

(6) Connection of Pt100 and JPt100 platinum temperature-measuring resistors

The Q64TCTT(BW) allows you to set the temperature measurement ranges which meet the operating temperatures of the Pt100 and JPt100.

(7) Choice of fine temperature measurement units and various control temperature ranges

The temperature measurement unit of each loop can be set to 1°C or 0.1°C in Centigrade or to 1°F or 0.1°F in Fahrenheit, enabling you to choose appropriate resolution for control. Also, the controllable temperature range can be selected from 0.0 to 400.0°C (when K type thermocouple is used), 0.0 to 3000.0°C (when R type thermocouple is used) and others, enabling you to make adequate setting for the object to be controlled.

(8) E^2PROM for backing up set values

The set values in buffer memory can be stored into E2PROM for data backup. Using the test function of GX Developer to write data directly to the buffer memory, what is required in a sequence program is "LD∗∗" + "OUT Yn1" at the minimum.

(9) Detection of disconnection

The Q64TCTTBW and Q64TCRTBW can detect the disconnection of a heater.

(10) Utility package for ease of setting

The optional utility package (GX Configurator-TC) is available.
Though you are not required to use the utility package, it allows initial and automatic refresh settings to be made on the screen, reducing sequence programs and also enabling you to check the setting and operating states and execute auto tuning easily.

1.2 The PID Control System

(1) The PID control system

Figure 1.3 indicates the system configuration when performing PID control.

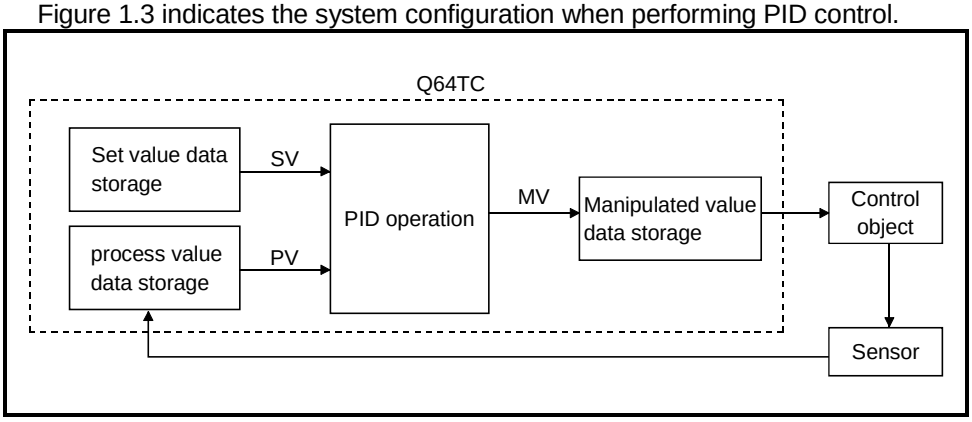


Fig. 1.3 The PID control system

(2) PID control procedure

The PID control is performed in the procedure shown in Figure 1.4 below:

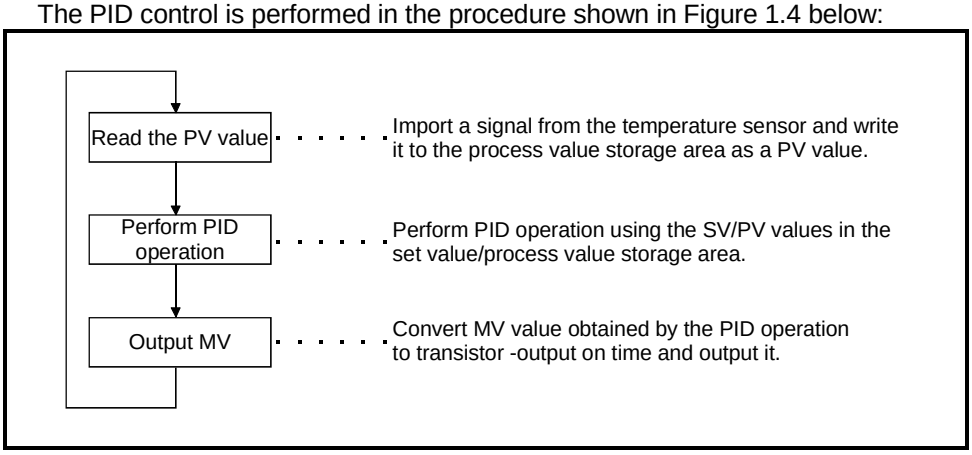

Read the PV value
Import a signal from the temperature sensor and write it to the process value storage area as a PV value.
Perform PID operation
Perform PID operation using the SV/PV values in the set value/process value storage area.
Output MV
Convert MV value obtained by the PID operation to transistor -output on time and output it.

Fig. 1.4 PID control procedure

(3) PID control (simplified two-level response selection)

In general, when the P, I, and D constants to improve the "response to the setting" are set, the "response to the disturbance" degrades by the PID control. Conversely, when the P, I, and D constants to improve the "response to the disturbance" are set, the "response to the setting" degrades by the PID control. In the PID control (simplified two-level response selection) of this module, "fast", "normal", or "slow" can be selected for the "response to the setting" while the P, I, and D constants for better "response for the disturbance" are selected.

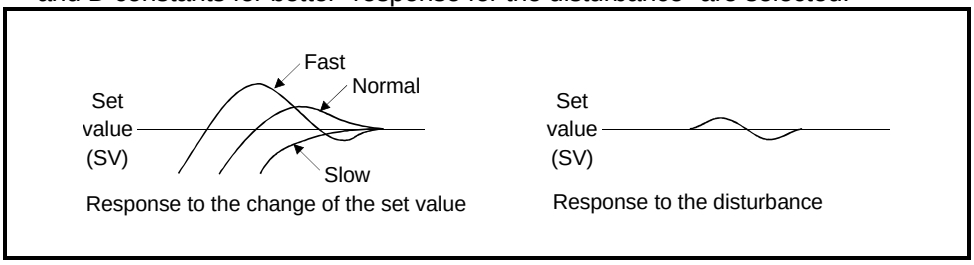


Fig. 1.5 simplified two-level response selection

1.3 About the PID Operation

The Q64TC can perform PID control in process-value incomplete differentiation.

1.3.1 Operation method and formula

The PID control in process-value incomplete differentiation is an operation method which puts the first-order delay filter as the input for derivative control action, and performs PID operation with the error value (E) after deleting the high-frequency noise component.

(1) The algorithm of the PID control in process-value incomplete differentiation is shown in Figure 1.6.

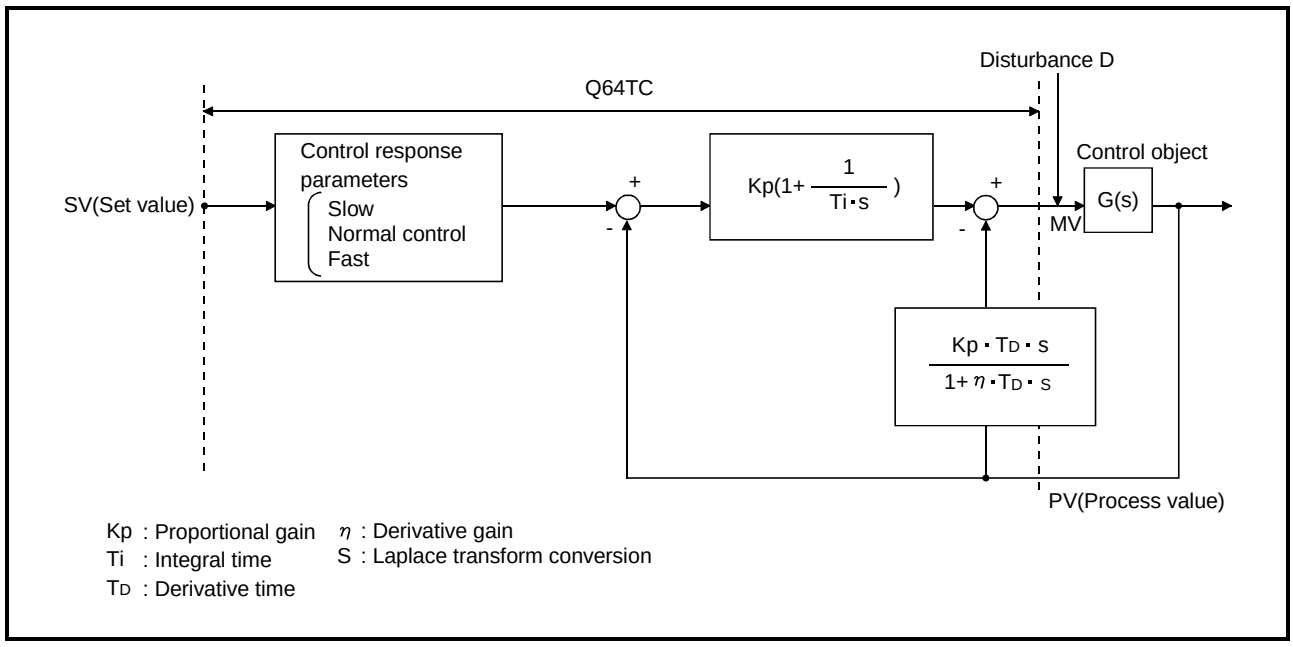


Fig. 1.6 Algorithm of PID control in process-value incomplete differentiation

(2) The formula used for Q64TC is shown below:

$$MV_n = MV_{n-1} + \frac{T_D}{\tau + \eta \cdot T_D}\left\{(PV_{n-1} - PV_n) - \frac{\tau}{T_D} \cdot MV_{n-1}\right\}$$

τ : Sampling period

MV : Incomplete derivative output

PV : Process value

T_D : Derivative time

$\frac{1}{\eta}$: Derivative gain

1.3.2 The Q64TC actions

The Q64TC performs PID operations in reverse action and forward action.

(1) Reverse action

In a reverse action, the process value (PV) increases toward the set value (SV) as the manipulation value (MV) increases.
The reverse action is effective for heat control.

(2) Forward action

In a forward action, the process value (PV) decreases toward the set value (SV) as the manipulation value (MV) increases.
The forward action is effective for cooler control.

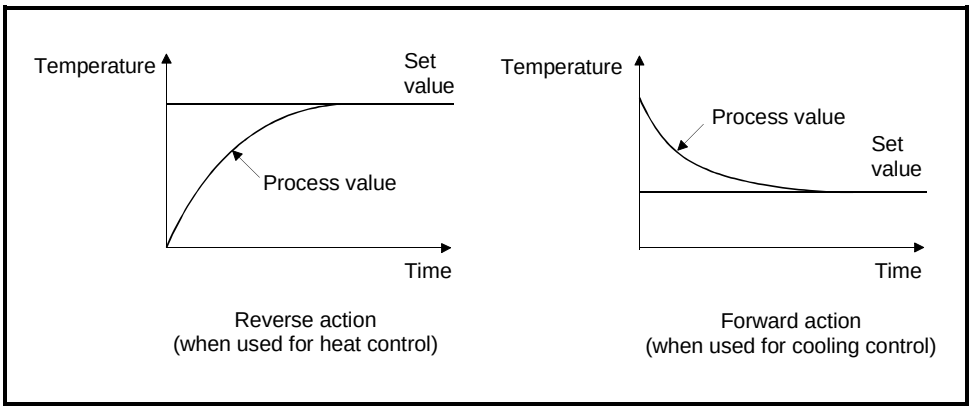


Fig. 1.7 Process control example in reverse action and forward action

1.3.3 Proportional action (P-action)

(1) The proportional action is an action to obtain the manipulation value proportional to the deviation (difference between set value and process value).

(2) With the proportional action, the relationship between the changes in the deviation and manipulation value can be expressed in the following formula:

$MV = K_P \cdot E$

where Kp is a proportional constant and is called the proportional gain.

(3) The proportional action for the step response when the error value is constant is shown in Figure 1.8.

(4) The manipulation value changes between -5.0% and 105.0 %. As the Kp increases, the manipulation value for the same error value becomes larger, and the corrective action becomes stronger.

(5) The proportional action will generate an offset (remaining deflection).

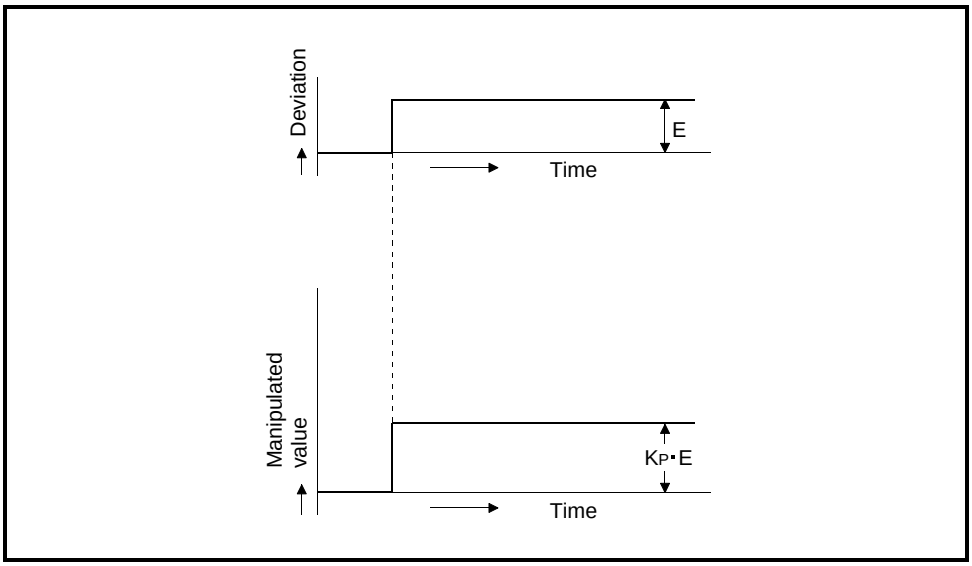


Fig. 1.8 Proportional action for step response

1.3.4 Integral action (I-action)

(1) The integral action is an action which continuously changes the manipulation value to eliminate the deviation when there is an deviation.
The offset produced by the proportional action can be eliminated.

(2) In the integral action, the time from the deviation occurrence until the manipulation value of the integral action becomes that of the proportional control action is called the integral time, and is indicated by T_I.

(3) The integral action for the step response when the error value is constant is shown in Figure 1.9.

(4) The integral action is used as a PI action in combination with the proportional action, or PID action in combination with the proportional and derivative actions.
The integral action cannot be used alone.

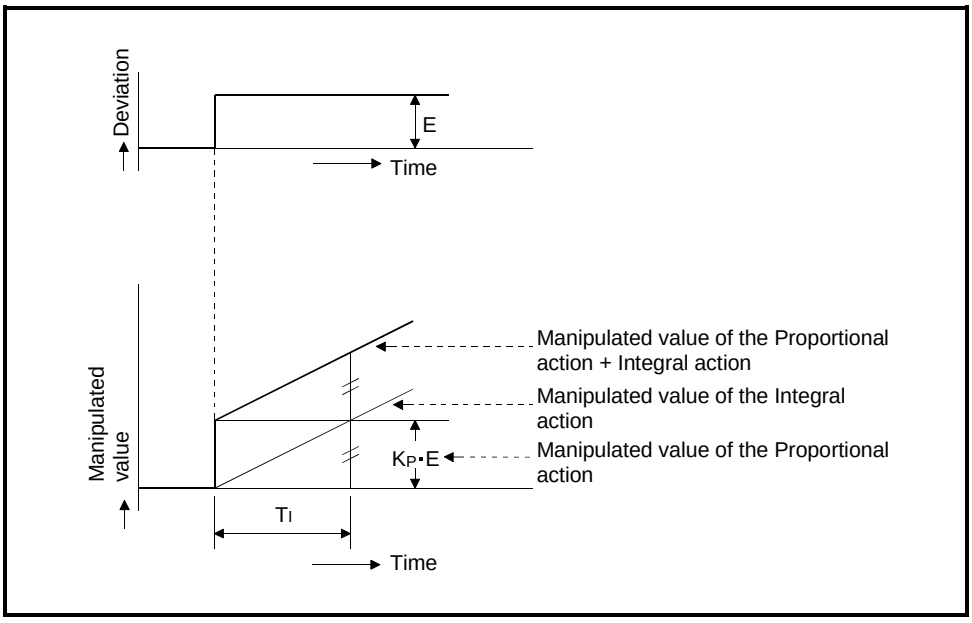


Fig. 1.9 Integral action for step response

1.3.5 Derivative action (D-action)

(1) The derivative action adds the manipulation value proportional to the change speed to eliminate error when an deviation occurs.
The derivative control action can prevent the control target from changing significantly due to disturbance.

(2) In the derivative action, the time from the deviation occurrence until the manipulation value of the derivative action becomes that of the proportional action is called the derivative time, and is indicated by T_D.

(3) The derivative action for the step response when the deviation is constant is shown in Figure 1.10.

(4) The derivative action is used as a PD action in combination with the proportional action, or PID action in combination with the proportional and integral actions.
The derivative action cannot be used alone.

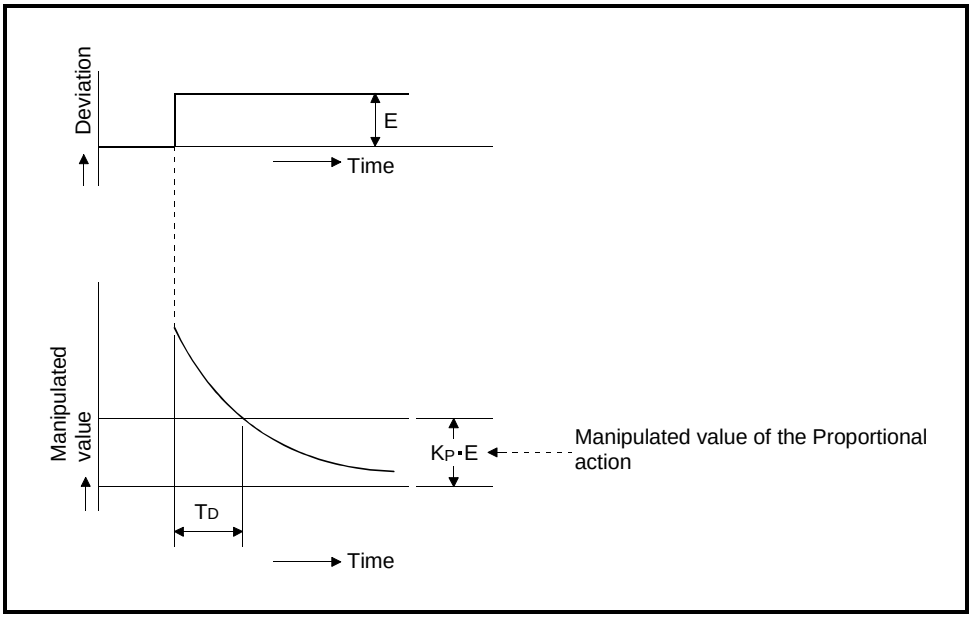


Fig. 1.10 Derivative action for step response

1.3.6 PID action

(1) The PID action performs control using the manipulation value obtained by merging proportional action, integral action and derivative action.

(2) The PID action for the step response when the deviation is constant is shown in Figure 1.11.

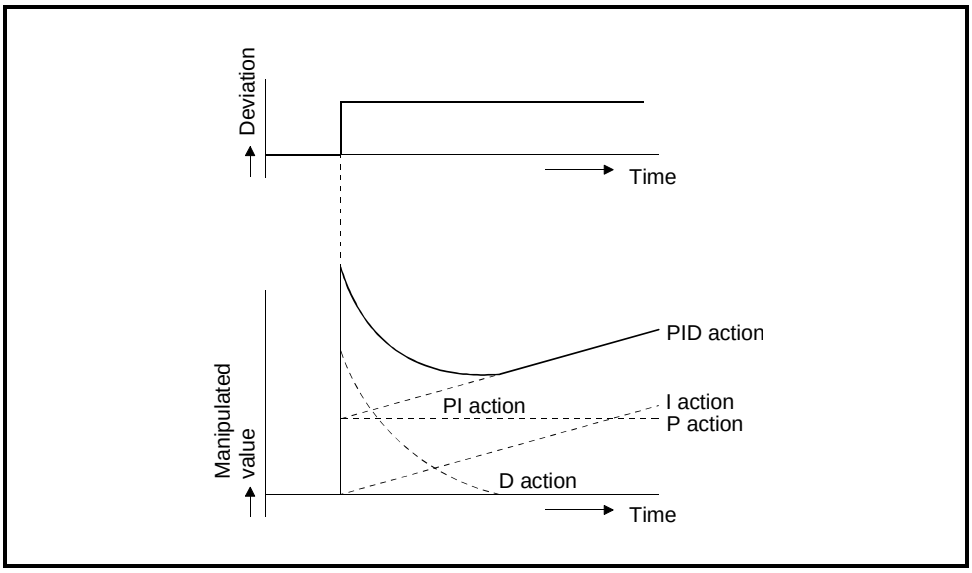


Fig. 1.11 PID action for step response

1.4 Functions Added to Function Version B and Later

(1) Functions added to function version B Q64TC

Function	Function summary	Reference section
Multiple PLC system support	Control from any desired PLC CPU by a multiple PLC system.	—
Auto tuning mode selection	Auto tuning mode selection corresponding to the response characteristics of the control object.	Section 3.5.47

(2) Functions added to function version C Q64TC

Function	Function summary	Reference section
Online module change	Change the module without stopping the system.	Chapter 7

POINT
See Section 2.2 for the confirmation methods of the function version.

2 SYSTEM CONFIGURATION

This chapter explains the system configuration of the Q64TC.

2.1 Applicable Systems

(1) Applicable modules and numbers of Q64TC modules that may be mounted

The following table indicates the CPU modules and network modules (for remote I/O stations) which accept the Q64TC, and the number of Q64TC modules that can be mounted.

Applicable module		Number of modules that can be installed		Remarks
		Q64TCTT/ Q64TCRT	Q64TCTTBW/ Q64TCRTBW	
CPU module	Q00JCPU	Maximum 16	Maximum 8	(＊1)
	Q00CPU Q01CPU	Maximum 24	Maximum 12	
	Q02CPU Q02HCPU Q06HCPU Q12HCPU Q25HCPU	Maximum 64	Maximum 32	Can be installed in Q mode only (＊1)
	Q12PHCPU Q25PHCPU	Maximum 64	Maximum 32	(＊1)
Network module	QJ72LP25-25 QJ72BR15 QJ72LP25G QJ72LP25GE	Maximum 64	Maximum 32	MELSECNET/H Remote I/O station (＊2)

＊1 See User's Manual (Function Explanation, Program Fundamentals) for the CPU module to use.
＊2 See Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network).

(2) Base unit which the conversion can be installed

The Q64TC can be mounted in any I/O slot (＊3) of a base unit.
However, combining it with other mounted modules may result in a power supply shortage depending on the number of modules to be mounted. Thus, always take into consideration the power supply capacity when mounting modules.

＊3 Within the I/O point ranges of the CPU modules and network modules (for remote I/O stations)

(3) Compatibility with a multiple PLC system

First read the QCPU User's Manual (Function Explanation, Program Fundamentals) if the Q64TC is used with a multiple PLC system.

(a) Compatible Q64TC
Use a Q64TC with function version B or higher if using the module in a multiple PLC system.

(b) Intelligent function module parameters
Perform PLC write of the intelligent function module parameters to the control PLC of the Q64TC only.

(4) Compatibility with online module change

To make an online module change, use the module of function version C or later.

POINT
The products of function version C include the functions of the products function versions A and B.

(5) Software packages supported

Correspondence between systems which use Q64TC and software packages are as shown below.

The GX Developer is necessary when using a Q64TC.

		Software Version	
		GX Developer	GX Configurator-TC
Q00J/Q00/Q01CPU	Single PLC system	Version 7 or later	Version 1.10L or later (cannot be used with the SW0D5C-QTCU-E 30D or earlier versions).
	Multiple PLC system	Version 8 or later	
Q02/Q02H/Q06H/ Q12H/Q25HCPU	Single PLC system	Version 4 or later	SW0D5C-QTCU-E 00A or later
	Multiple PLC system	Version 6 or later	SW0D5C-QTCU-E 30D or later
Q12PH/Q25PHCPU	Single PLC system	Version 7.10L or later	Version 1.13P or later (cannot be used with the SW0D5C-QTCU-E 30D or earlier versions).
	Multiple PLC system		
If installed in a MELSECNET/H remote I/O station		Version 6 or later	SW0D5C-QTCU-E 30D or later

(6) Current sensors

Only the following current sensors of URD, Ltd. are usable with the Q64TCTTBW and Q64TCRTBW.

- CTL-12-S36-8(0.0 to 100.0A)
- CTL-6-P-H(0.0 to 20.00A) (The conventional model CTL-6-P is also usable.)

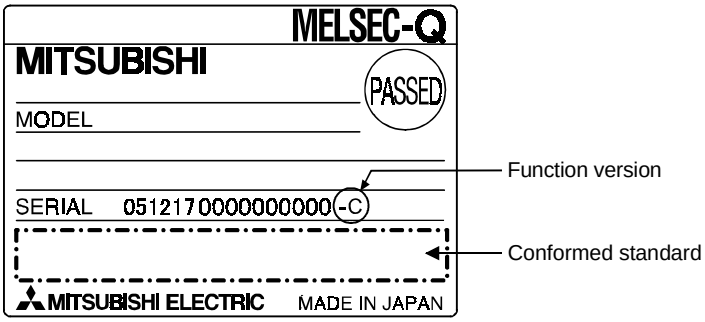
2 - 2

2.2 How to Check the Function Version and Software Version

This section describes how to check the function version of the Q64TC and the GX Configuration-TC software version.

(1) How to check the function version of the Q64TC

(a) To check the version using the "SERIAL column of the rating plate" located on the side of the module



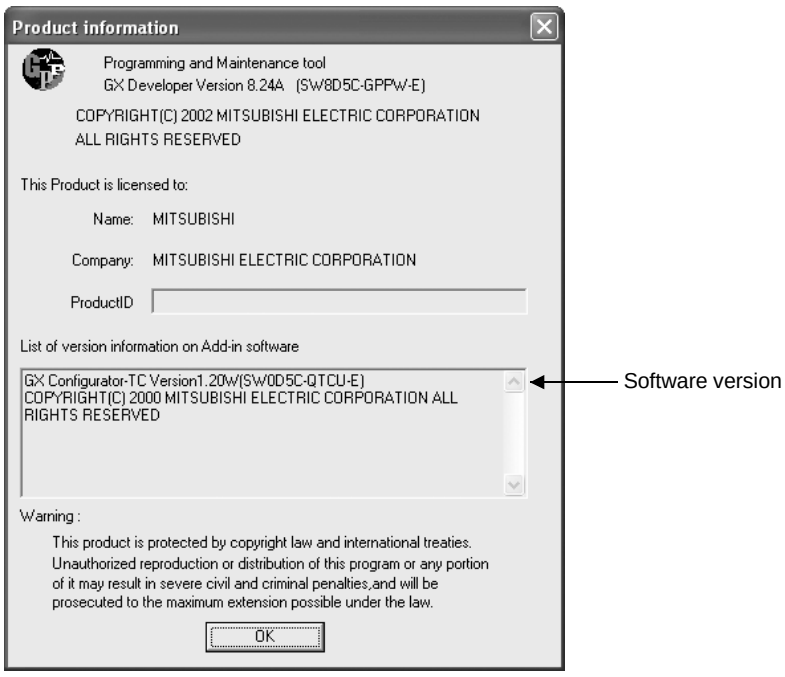
(b) To check the version using the GX Developer
See Section 8.10 of this manual.

(2) How to check the GX Configuration-TC software version

The GX Configuration-TC software version can be checked in GX Developer's "Product information" screen.

[Startup procedure]

GX Developer → "Help" → Product information


Product information
Programming and Maintenance tool
GX Developer Version 8.24A (SW8D5C-GPPW-E)
COPYRIGHT(C) 2002 MITSUBISHI ELECTRIC CORPORATION
ALL RIGHTS RESERVED
This Product is licensed to:
Name: MITSUBISHI
Company: MITSUBISHI ELECTRIC CORPORATION
ProductID
List of version information on Add-in software
GX Configurator-TC Version1.20W(SW0D5C-QTCU-E)
COPYRIGHT(C) 2000 MITSUBISHI ELECTRIC CORPORATION ALL RIGHTS RESERVED
Software version
Warning :
This product is protected by copyright law and international treaties.
Unauthorized reproduction or distribution of this program or any portion of it may result in severe civil and criminal penalties,and will be prosecuted to the maximum extension possible under the law.
OK

(In the case of GX Developer Version 7)

REMARK

The version indication for the GX Configurator-TC has been changed as shown below from the SW0D5C-QTCU-E 30D upgrade product.

Previous product		Upgrade and subsequent versions
SW0D5C-QTCU-E 30D	→	GX Configurator-TC Version 1.10L

3 SPECIFICATIONS

This chapter provides the performance specifications of the Q64TC, I/O signals transferred to/from the PLC CPU and the specifications of buffer memory.
For the general specifications of the Q64TC, refer to the User's Manual (hardware) of the CPU module used.

3.1 Performance Specifications

3.1.1 Performance specifications of the Q64TC

Table 3.1 Q64TC performance specification list

			Specifications			
			Q64TCTT	Q64TCRT	Q64TCTTBW	Q64TCRTBW
Control output			Transistor output			
Number of temperature input points			4 channels/module			
Usable thermocouples/platinum temperature-measuring resistors			Refer to Section 3.1.2.			
Acc-uracy *1	Indication accuracy	Ambient temperature: 25°C±5°C	Full-scale x (±0.3%)			
		Ambient temperature: 0 to 55°C	Full-scale x (±0.7%)			
	Cold junction temperature compensation accuracy (Ambient temperature: 0 to 55°C)	Temperature measurement value: -100°C or more	Within ±1.0°C	———	Within ±1.0°C	———
		Temperature measurement value: -150 to -100°C	Within ±2.0°C		Within ±2.0°C	
		Temperature measurement value: -200 to -150°C	Within ±3.0°C		Within ±3.0°C	
Sampling period			0.5s/4 channels (constant independently of the number of channels used)			
Control output period			1 to 100s			
Input impedance			1MΩ			
Input filter			0 to 100s (0: Input filter off)			
Sensor compensation value setting			-50.00 to 50.00%			
Operation at sensor input disconnection			Upscale processing			
Temperature control system			PID ON/OFF pulse or 2-position control			
PID constant range	PID constant setting		Setting can be made by auto tuning			
	Proportional band (P)		0.0 to 1000.0% (0: 2-position control)			
	Integral time (I)		1 to 3600s			
	Derivative time (D)		0 to 3600s (set 0 for PI control.)			
Set value setting range			Within temperature range set to the used thermocouple/platinum temperature-measuring resistor			
Dead band setting range			0.1 to 10.0%			
Transistor output	Output signal		ON/OFF pulse			
	Rated load voltage		10 to 30VDC			
	Max. load current		0.1A/point, 0.4A/common			
	Max. inrush current		0.4A 10ms			
	Leakage current at OFF		0.1mA or less			
	Max. voltage drop at ON		1.0VDC (TYP) 0.1A 2.5VDC (MAX) 0.1A			
	Response time		OFF→ON: 2ms or less, ON→OFF: 2ms or less			
E^2PROM write count			Max. 100 thousand times			
Insulation method			Between input and grounding : Transformer insulation Between input and channel : Transformer insulation			
Dielectric strength			Between input and grounding : 500VAC for 1 minute Between input and channel : 500VAC for 1 minute			
Insulation resistance			Between input and grounding : 500VDC 20MΩ or more Between input and channel : 500VDC 20MΩ or more			

		Specifications			
		Q64TCTT	Q64TCRT	Q64TCTTBW	Q64TCRTBW
Heater disconnection detection specifications	Current sensor	————		Refer to Section 2.1	
	Input accuracy			Full scale x (±1.0%)	
	Number of alert delays			3 to 255	
I/O occupied points ＊2		16 points/slot (I/O assignment: 16 intelligent points)		32 points/2 slots (Default I/O assignment : 16 free points + 16 intelligent points)	
Connection terminal		18-point terminal block		Two 18-point terminal blocks	
Applicable wire size		0.3 to 0.75mm^2			
Applicable crimping terminal		R1.25-3,1.25-YS3,RAV1.25-3,V1.25-YS3A			
Internal current consumption		0.55A		0.64A	
Weight		0.20kg		0.30kg	
Outline dimensions		27.4mm(1.08in.)(W)×98mm(3.86in.)(H) ×112mm(4.41in.)(D)		55.2mm(2.17in.)(W)×98mm(3.86in.)(H) ×112mm(4.41in.)(D)	

3

＊1: Calculate the accuracy in the following method.
(Accuracy) = (indication accuracy) + (cold junction temperature compensation accuracy)
Example) Accuracy at the input range setting of "38", operating ambient temperature of 35°C and temperature measurement value of 300°C
{400.0 - (-200.0)} [Full-scale] × (±0.007) [±0.7%] + (±1.0°C) [Cold junction temperature compensation accuracy] = ±5.2°C

＊2: When the Q64TCTTBW or Q64TCRTBW is used, the device numbers of the I/O signals increase by 16 points depending on how many free points the left-hand side slots have.
Hence, as I/O signals are given as indicated below in this manual, read them according to the module used.
Example) When a signal is given as Yn1
When Q64TCTT or Q64TCRT is used: Y1 When Q64TCTTBW or Q64TCRTBW is used: Y11

＊3: For the noise immunity, dielectric withstand voltage, insulation resistance and others of the PLC system which uses this module, refer to the power supply module specifications given in the User's Manual of the CPU module used.

3.1.2 Usable temperature sensor types, measurement temperature ranges and data resolutions

(1) For use of Q64TCTT(BW)

Table 3.2 Thermocouple type, measurement temperature range and data resolution list

Thermocouple type	°C		°F	
	Measurement temperature range	Data resolution	Measurement temperature range	Data resolution
R	0 to 1700	1	0 to 3000	1
K	0 to 500 0 to 800 0 to 1300	1	0 to 1000 0 to 2400	1
	-200.0 to 400.0 0.0 to 400.0 0.0 to 500.0 0.0 to 800.0	0.1	0.0 to 1000.0	0.1
J	0 to 500 0 to 800 0 to 1200	1	0 to 1000 0 to 1600 0 to 2100	1
	0.0 to 400.0 0.0 to 500.0 0.0 to 800.0	0.1	0.0 to 1000.0	0.1
T	-200 to 400 -200 to 200 0 to 200 0 to 400	1	0 to 700 -300 to 400	1
	-200.0 to 400.0 0.0 to 400.0	0.1	0.0 to 700.0	0.1
S	0 to 1700	1	0 to 3000	1
B	0 to 1800	1	0 to 3000	1
E	0 to 400 0 to 1000	1	0 to 1800	1
	0.0 to 700.0	0.1	———	———
N	0 to 1300	1	0 to 2300	1
U	0 to 400 -200 to 200	1	0 to 700 -300 to 400	1
	0.0 to 600.0	0.1	———	———
L	0 to 400 0 to 900	1	0 to 800 0 to 1600	1
	0.0 to 400.0 0.0 to 900.0	0.1	———	———
PL II	0 to 1200	1	0 to 2300	1
W5Re/W26Re	0 to 2300	1	0 to 3000	1

(2) For use of Q64TCRT(BW)

Table 3.3 Usable platinum temperature-measuring resistors, measurement temperature ranges and data resolutions

Platinum temperature-measuring resistor	°C		°F	
	Measurement temperature range	Data resolution	Measurement temperature range	Data resolution
Pt100	-200.0 to 600.0	0.1	-300 to 1100	1
	-200.0 to 200.0		-300.0 to 300.0	0.1
JPt100	-200.0 to 500.0	0.1	-300 to 900	1
	-200.0 to 200.0		-300.0 to 300.0	0.1

3.2 Function Summary

The Q64TC function summary is shown in Table 3.3.

Table 3.3 Q64TC function summary

Item	Specification	Reference
Auto-tuning function	• The temperature control module automatically sets the optimal PID constants.	3.2.1
Forward action/reverse action selection function	• Heat control (reverse action) or cooling control (forward action) can be selected and controlled.	3.2.2
RFB limiter function	• Limit the manipulation value overshoot which frequently occurs when the set value (SV) is changed or control target is changed.	3.2.3
Sensor compensation function	• Reduces the difference between the measured value and actual temperature to zero when these two are different due to measurement conditions, etc.	3.2.4
Unused channel setting	• Sets the PID operation for channels that do not perform temperature adjustment to "not execute."	3.2.5
PID control forced stop	• Stops the PID operation for channels that is performing temperature adjustment.	3.2.6
Heater disconnection detection function	• Measures the current that flows in the heater main circuit and detects disconnection when Q64TCTTBW or the Q64TCRTBW is used.	3.2.7
Current error detection function when output is off	• When the Q64TCTTBW or the Q64TCRTBW is used, this function measures the current in the heater's main circuit while the transistor's output is off, and checks if there is a current error when output is off.	3.2.8
Loop disconnection detection function	• A function to detect errors in the control system (control loop) caused by a load (heater) disconnection, abnormal external operation device (such as magnet relay), or a thermocouple disconnection.	3.2.9
Data storage in E^2PROM	• By backing up the buffer memory contents to E^2PROM, the load of sequence program can be reduced.	3.2.10
Alert alarm	• Monitors the process value (PV) and alerts the user.	3.2.11
Control output setting for CPU stop error occurrence	• This function continues/stops temperature adjustment control output at CPU stop error occurrence.	3.2.12
Q64TC control status	• The Q64TC can be controlled by the output signal of Q64TC and the settings in the buffer memory.	3.2.13
Online module change	• A module change is made without the system being stopped.	Chapter 7

3.2.1 Auto tuning function

(1) What is the auto tuning function?

(a) The auto tuning function is designed for the Q64TC to set the optimum PID constants automatically.
In auto tuning, the PID constants are calculated according to the hunting cycle and amplitude which take place when a manipulated value turned on/off alternates between overshooting and undershooting a set value.

(b) Setting the following data enables auto tuning to be executed. Note that since actual control starts on completion of auto tuning, the other data should be preset to the values used for actual operation.
∗When "0" has been set to the proportional band (P), auto tuning is not executed.

Buffer memory address name	Addresses (Hexadecimal)			
	CH1	CH2	CH3	CH4
Input range	20H	40H	60H	80H
Set value (SV) setting	22H	42H	62H	82H
Upper output limiter	2AH	4AH	6AH	8AH
Lower output limiter	2BH	4BH	6BH	8BH
Output variation limiter	2CH	4CH	6CH	8CH
Sensor compensation value setting	2DH	4DH	6DH	8DH
Control output period setting	2FH	4FH	6FH	8FH
Primary delay digital filter setting	30H	50H	70H	90H
AUTO/MAN mode switching	32H	52H	72H	92H
AT bias	35H	55H	75H	95H
Forward/reverse action setting	36H	56H	76H	96H
Auto tuning mode selection	B8H	B9H	BAH	BBH

(c) On completion of auto tuning, calculated values are set to the following buffer memory addresses.

Buffer memory address name	Addresses (Hexadecimal)			
	CH1	CH2	CH3	CH4
Proportional band (P) setting	23H	43H	63H	83H
Integral time (I) setting	24H	44H	64H	84H
Derivative time (D) setting	25H	45H	65H	85H
Loop disconnection detection judgment time ∗	3BH	5BH	7BH	9BH

∗: As the loop disconnection detection judgment time, a value twice greater than the calculated integral time is set. However, the loop disconnection detection judgment time remains unchanged from 0 when it is 0 at an auto tuning start.

(2) Executing auto-tuning

(a) Conditions for starting auto-tuning

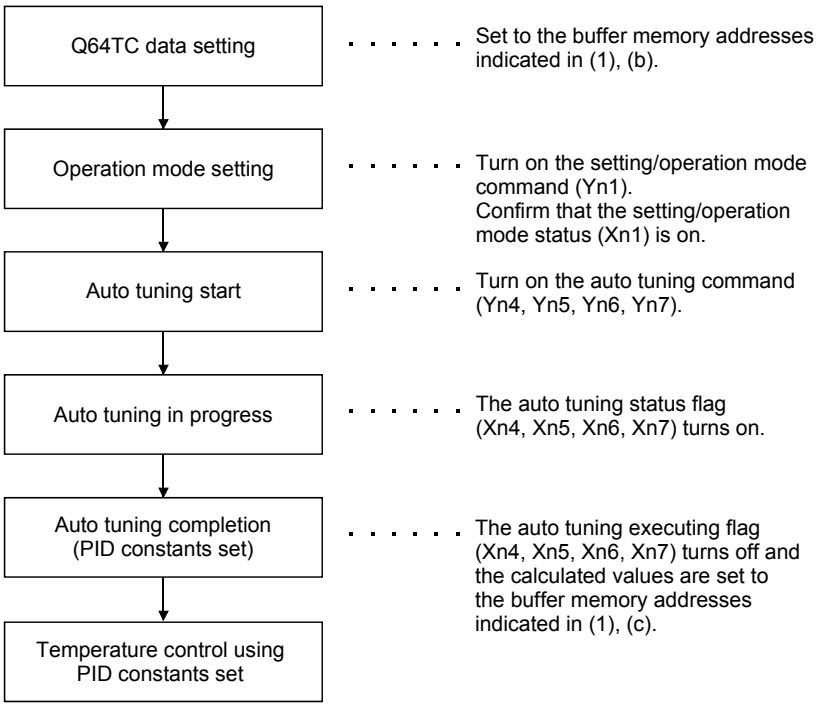
When any of the following conditions is met, auto-tuning is not executable.

1) The module is in the setting mode (Xn1: OFF).
2) In the proportional section setting (buffer memory address: 23H, 43H, 63H, 83H), 0 is set. (2-position control)
3) In the AUTO/MAN setting (buffer memory address: 32H, 52H, 72H, 92H), 1 (Manual) is set.
4) In the Unused channel setting (buffer memory address: 3DH, 5DH, 7DH, 9DH), 1 (Unused) is set for the channel.
5) The PID control forced stop command (YnC to YnF) is ON.
6) Hardware failure is identified. (The ERR. LED turns ON.)
7) The measured temperature value (PV) (buffer memory address: 9H to CH) exceeds the measured temperature range (Refer to Section 3.5.4).

For conditions 1) to 5), auto-tuning starts as soon as the condition is changed.

For condition 6) and 7), the auto-tuning status flag (Xn4 to Xn7) turns on momentarily. Auto-tuning does not start until the auto-tuning status flag (Xn4 to Xn7) turns on again (OFF to ON) even if the condition is changed.

(b) Auto tuning is performed in the following procedure.


Q64TC data setting
Set to the buffer memory addresses indicated in (1), (b).
Operation mode setting
Turn on the setting/operation mode command (Yn1).
Confirm that the setting/operation mode status (Xn1) is on.
Auto tuning start
Turn on the auto tuning command (Yn4, Yn5, Yn6, Yn7).
Auto tuning in progress
The auto tuning status flag (Xn4, Xn5, Xn6, Xn7) turns on.
Auto tuning completion (PID constants set)
The auto tuning executing flag (Xn4, Xn5, Xn6, Xn7) turns off and the calculated values are set to the buffer memory addresses indicated in (1), (c).
Temperature control using PID constants set

POINT

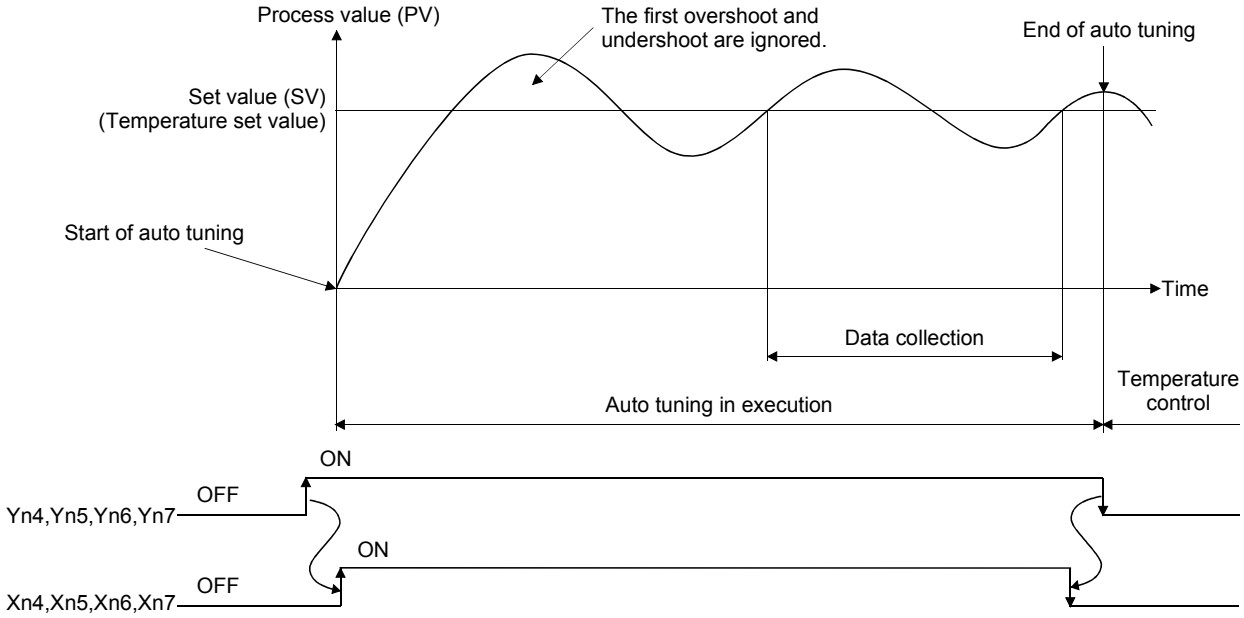
After powering off the PLC CPU, you can use the set PID constants in the following method.

- Write the values directly to the buffer memory using the sequence program.
- Store the PID constants into E^2PROM and transfer them when powering on the PLC CPU.
- Use the initial settings of the GX Configurator-TC.

(c) Auto tuning operation

Auto tuning performs operation as shown below.

1) Auto tuning output is provided.
2) Data collection starts when the process value returns to the set value after the first overshoot and undershoot.
3) After data collection, auto tuning ends when PID constants and loop disconnection detection judgment time are set.



(d) Precautions for auto tuning

The following indicate the conditions under which auto tuning will result in abnormal termination.

1) The setting/operation mode command (Yn1) has been turned OFF. (Except for the case where the PID continue flag (buffer memory address: A9H) is "Continue".)
2) Any of the following setting items for the channel has been changed during execution of auto-tuning.

Setting item	Buffer memory address (Hexadecimal)			
	CH1	CH2	CH3	CH4
Set value (SV) setting	22H	42H	62H	82H
Upper output limiter	2AH	4AH	6AH	8AH
Lower output limiter	2BH	4BH	6BH	8BH
Sensor compensation value setting	2DH	4DH	6DH	8DH
Primary delay digital filter setting	30H	50H	70H	90H
AUTO/MAN mode switch	32H	52H	72H	92H
AT bias	35H	55H	75H	95H
Forward/reverse operation setting	36H	56H	76H	96H
Unused channel setting	3DH	5DH	7DH	9DH

3) The measured temperature value (PV) (buffer memory address: 9H to C H) exceeds the measured temperature range (refer to section 3.5.4).

4) The following time exceeds 2 hours.
   • Time elapsed from the auto-tuning start until the set value is reached at the first time.
   • A half of the hunting cycle
     The value calculated by PID constants after auto-tuning exceeds any of the following ranges.
5) Proportional section (P): 0.1 to 1000.0 (%)
   Integral time (I): 1 to 3600 (s)
   Derivative time (D): 0 to 3600 (s)
6) The PID control forced stop command (YnC to YnF) has been turned ON.
7) Hardware failure has occurred.
8) The proportional section (P) setting (buffer memory address: 23H, 43H, 63H, 83H) has been changed to 0. (2-position control)
9) The upper setting limiter (buffer memory address: 37H, 57H, 77H, 97H) or the lower setting limiter (buffer memory address: 38H, 58H, 78H, 98H) has been changed and thereby the set value (SV) is outside the setting range.

(3) Operation at termination of auto tuning

(a) Operation at normal termination
- The auto tuning status flag (Xn4 to Xn7) turns off.
- The PID constants are set.
- The loop disconnection detection judgment time (buffer memory addresses: 3BH, 5BH, 7BH, 9BH) is set. (If the loop disconnection detection judgment time is 0 at the start of auto tuning, it remains unchanged from 0.)

(b) Operation at abnormal termination
- The auto tuning status flag (Xn4 to Xn7) turns off.
- The PID constants are not set.

(4) Adjustment after auto tuning

(a) Specific readjustment is not needed for the PID constants calculated by auto tuning.

(b) Use the control response parameters (buffer memory addresses: 31H, 51H, 71H, 91H) to change the control response for the PID constants calculated by auto tuning.

REMARK

1) The time between the start and completion of auto tuning depends on the object to be controlled.
2) You can confirm that auto tuning has been completed by checking that the auto tuning status flag (Xn4, Xn5, Xn6, Xn7) has turned from on to off.
3) When the automatic backup setting (3FH, 5FH, 7FH, 9FH) is preset at an auto tuning start to be made valid after auto tuning of the PID constants, the PID constants and loop disconnection detection judgment time are automatically backed up by E^2PROM on completion of auto tuning.

3.2.2 Reverse/Forward action select function

With the Q64TC, "reverse action" or "forward action" can be selected to perform the PID operations.

(1) Q64TC default

The default is set at "reverse action" for Q64TC.
When performing the PID operations with the "forward action," set to the forward action in the reverse/forward action selection buffer memory(36H,56H,76H, and 96H).

(2) Reverse/forward action control details

(a) Reverse action : Used for heating control to increase temperature.
(b) Forward action : Used for cooling control to decrease temperature.

3.2.3 RFB limiter function

(1) RFB(Reset feed back) limiter function

The RFB limiter function limits the PID operation result (manipulated value : MV) not to exceed the valid range by the integral control action when an error continues for a long time.
With the RFB limiter function, if the PID operation result exceeds the upper/lower output limiter value, the amount exceeded is fed back to the integral value and the PID operation result is kept at the limit value.

3.2.4 Sensor compensation function

(1) Sensor compensation function

The sensor compensation function compensates the difference between the measured temperature and actual temperature caused by measurement conditions.

(2) Sensor compensation value setting

When there is a difference between the measured temperature and actual temperature, the full-scale percentage (-50.00 to 50.00%) is set in the buffer memory for sensor compensation value setting (2DH, 4DH, 6DH and 8DH) as the sensor compensation value.
For example, when the input range is at -200°C to 200°C and there is a 2°C error, the full-scale is 400°C(200°C-(-200°C)=400°C).
Therefore, 2/400 x 100 = 0.5% is set.("50" is set in the buffer memory.)

3.2.5 Unused channel setting

(1) Channels where temperature sensors are not connected

The Q64TC performs upscale processing on the channels where temperature sensors (thermocouples/platinum temperature-measuring resistors) are not connected.

Hence, when a temperature sensor is not connected to the channel which will not exercise temperature control, the PV value is judged as higher than the temperature measurement range of the input range, and the "ALM" LED is lit by alert processing.

(2) Unused channel setting

(a) To make unused channel setting, write "1" to the unused channel setting buffer memory.

(b) After the unused channel setting has been made, no alert will occur at the channel with no temperature sensor connected and the "ALM" LED will not be lit.

The sampling period remains unchanged if the unused channel setting is performed.

3.2.6 Forced PID control stop

(1) Forced PID control stop

Forced PID control stop is a function to stop PID operations temporarily from the PLC CPU.

The action to be taken by the Q64TC at a PID operation stop depends on the setting of the stop mode setting buffer memory (21_H, 41_H, 61_H, 81_H).

(2) Executing forced PID control stop

To execute a forced PID control stop, turn on the forced PID control stop command (YnC to YnF).

At this time, the manipulated value storage buffer memory (D_H to 10_H) value is -50 (-5.0%).

(3) Canceling forced PID control stop

When the forced PID control stop command is turned off, a forced PID control stop is canceled and PID operations are resumed at the manipulated value which was output during the forced PID control stop.

POINT
Setting the PLC CPU to the STOP status turns off the forced PID control stop command, "canceling the forced PID control stop".

3.2.7 Heater disconnection detection function (supported only by Q64TCTTBW, Q64TCRTBW)

(1) Heater disconnection detection function

(a) This is a function to check if there is a heater wire breakage using the standard heater current value (load current value detected by the current sensor (CT)), when the transistor output is on.

(b) The heater disconnection detection function compares the current values of standard heater and heater disconnection alert, and determines that there is a heater wire breakage when the current value of standard heater is below that of heater disconnection alert.
However, when the transistor turned-on time is less than 0.5 seconds, the heater disconnection detection is not performed.

(2) Heater disconnection compensation function

(a) Heater disconnection compensation
When the heater voltage drops, the heater current decreases as well.
The Q64TCTTBW, Q64TCRTBW heater disconnection detection measures the heater current and determines the heater disconnection.
Therefore, when the heater voltage drops, there are possibilities that a false alarm may be set due to the voltage change.
Therefore, the Q64TCTTBW, Q64TCRTBW compensates for a drop in heater current (heater breakage compensation) so that the drop in heater current does not activate the break detection.

(b) Heater disconnection compensation method
The heater disconnection compensation calculates "the heater current for each channel" - "standard current," and the largest positive value is set as the compensation value.
When there is no positive values, the value with the smallest negative value is used as the compensation value.
The heater current for each channel is compensated with the compensation value and a heater disconnection is detected when the compensated value exceeds the specified heater disconnection detection setting value.

Example 1: When the difference from the standard current at each channel is: Channel 1: -2%, Channel 2: 5%, Channel 3: -1%, Channel 4: -17%, the compensation value becomes 5%.
The heater disconnection detection is performed from the values after a 5% compensation: Channel 1: -7%, Channel 2: 0%, Channel 3: -6%, Channel 4: -22%.
Thus, when the heater disconnection detection setting value is at 80%, only channel 4 is detected as disconnected.

Channel No.	Heater disconnection detection setting value	Difference from the standard current	Compensation value	Difference from the standard current after compensation	Disconnected
1	80%	-2%	5%	-7%	No
2		5%		0%	No
3		-1%		-6%	No
4		-17%		-22%	Yes

Example 2: The difference from the standard current at each station is: Channel 1: -16%, Channel 2: -17%, Channel 3: -22%, Channel 4: -19%, the compensation value becomes -16%.
The heater disconnection detection is performed from the values after a -16% compensation: Channel 1: 0%, Channel 2: -1%, Channel 3: -6%, Channel 4: -3%. Thus, when the heater disconnection detection setting value is at 80%, none of the channels are detected as disconnected.

Channel No.	Heater disconnection detection setting value	Difference from the standard current	Compensation value	Difference from the standard current after compensation	Disconnected
1	80%	-16%	-16%	0	No
2		-17%		-1%	No
3		-22%		-6%	No
4		-19%		-3%	No

(c) Restrictions
- The heater-disconnection compensation function will not work if only one channel is used.
- The heater-disconnection compensation function will not work if only one channel is used to keep the heater on while the others are used to keep it off.
  The module may detect a disconnection even when the heater is not disconnected.
- The heater disconnection detection compensation value is up to 20%.
  Therefore, when there is a voltage drop by more than 40%, a disconnection is detected even with a 20% compensation.

3.2.8 Output off-time current error detection function (available for Q64TCTTBW and Q64TCRTBW only)

(1) Using the reference heater current value (load current value detected by the current sensor (CT)), this function checks for a transistor output off-time current error when the transistor output is off.

(2) The transistor output off-time current error detection function compares the reference heater current value and the current value of the heater disconnection alert, and judges it as an output off-time current error if the reference heater current value is higher than the current value of the output off-time current alert.
Note that output off-time current error detection will not be made if the transistor output off period is within 0.5 seconds.

3.2.9 Loop disconnection detection function

The loop disconnection detection function detects errors in the control system (control loop) caused by a load (heater) disconnection, external operation device (e.g. magnetic relay) fault, input disconnection and others.
When the PID operation value has reached 100% or 0%, this function starts monitoring the variation of the process value per loop disconnection detection judgment time to detect a heater or input disconnection.

(1) When the heater is disconnected, when the input is disconnected or shorted, or when the external operation device contact does not turn on, it is judged as an error since the temperature will not rise despite the control output provided.
In this case, an alert is output if a temperature rise of 2°C or more is not observed within the preset loop disconnection detection judgment time after the control output is provided 100%.

(2) When the input is disconnected or when the external operation device contact is welded, it is judged as an error since the temperature will rise though the control output is not provided.
In this case, an alert is output if a temperature fall of 2°C or more is not observed within the preset loop disconnection detection judgment time after the control output has dropped to 0%.
(In either case, inverse operation will be performed for forward action: cooling control.)

POINT
(1) When not using the loop disconnection detection function, set the loop disconnection detection judgment time to "0".
(2) Setting the loop disconnection detection dead band will not cause a loop disconnection if there is no temperature variation of 2°C or more when the control output is provided 100% or 0% at the set value. (Refer to Section 3.5.32.)

3.2.10 Data storage on E^2PROM

(1) Data storage on E^2PROM

(a) The Q64TC buffer memory data can be stored onto E^2PROM for backup.
The whole write-enabled area of the buffer memory can be backed up. Refer to Section 3.5 for details of the buffer memory.

<table>
<tr><th colspan="4">Buffer memory backed-up addresses (Hexadecimal)</th><th>Remarks</th></tr>
<tr><td>20H to 38H</td><td>40H to 58H</td><td>60H to 78H</td><td>80H to 98H</td><td rowspan="8">————</td></tr>
<tr><td>3AH to 3DH</td><td>4AH to 5DH</td><td>6AH to 7DH</td><td>8AH to 9DH</td></tr>
<tr><td colspan="4">A4H to AAH</td></tr>
<tr><td colspan="4">AFH</td></tr>
<tr><td colspan="4">B0H</td></tr>
<tr><td colspan="4">B5H</td></tr>
<tr><td>C0H to C3H</td><td>D0H to D3H</td><td>E0H to E3H</td><td>F0H to F3H</td></tr>
<tr><td colspan="4">108H to 11FH</td><td>Q64TCTTBW,
Q64TCRTBW only</td></tr>
</table>

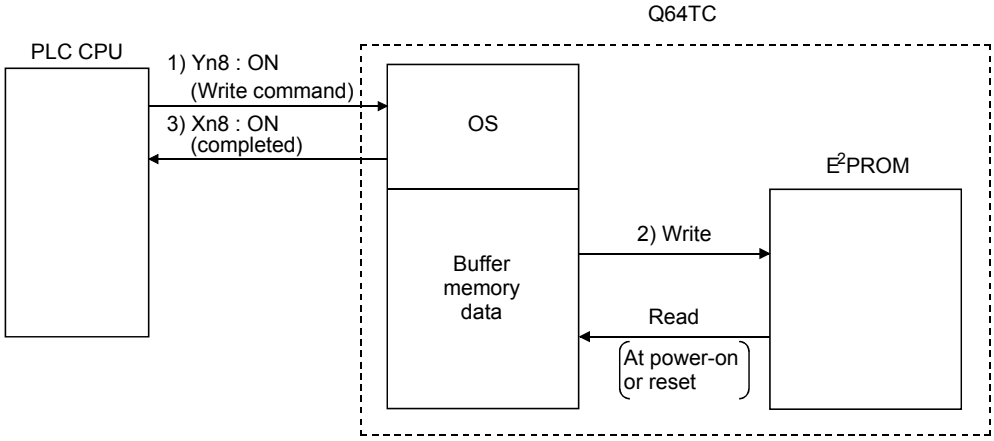
Write to E^2PROM can be used to back up the PID constants set by auto tuning and the data written directly to the buffer memory using a peripheral device.
Write to E^2PROM eliminates the program used to set data to the Q64TC.

(b) The backed up data is transferred from E^2PROM to buffer memory when the PLC CPU is powered on (power is switched on) or reset.
Hence, temperature control can be exercised without data being written when the PLC CPU is powered on or reset.

(2) Writing data to E^2PROM

(a) When writing data to E^2PROM, turn on the E^2PROM backup command (Yn8).
- The E^2PROM write completion flag (Xn8) turns on at completion of data write to E^2PROM.
- The E^2PROM write failure flag (XnA) turns on if write of data to E^2PROM is not completed normally.

(b) Make changes to buffer memory when the E^2PROM write completion flag is off.



(3) Reading data from E^2PROM

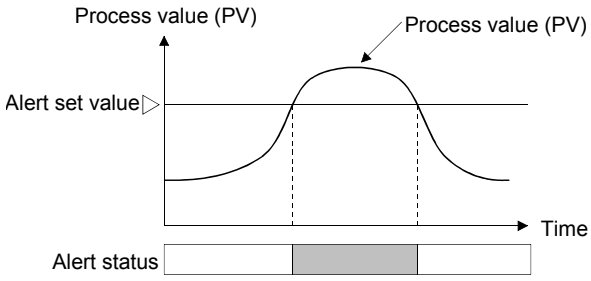
E^2PROM data read occurs under either of the following conditions.
- When the PLC CPU is powered on or reset.
- When the E^2PROM's PID constant read command (3EH, 5EH, 7EH, 9EH) turns on. Note that the read data are only the PID constants and loop disconnection detection judgment time of the corresponding channel.

3.2.11 Alert alarms

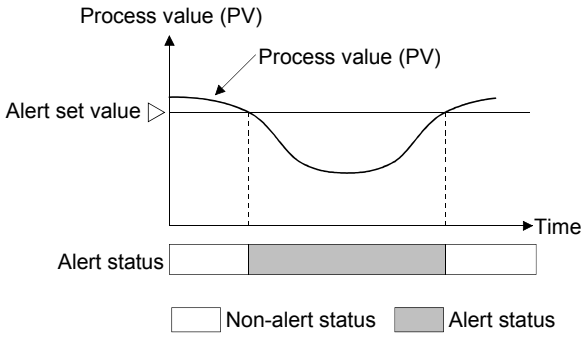
(1) The alert alarm is a function which sets the system in an alert status when the process value (PV) or deviation reaches the alert set value. It is used to turn on the device's hazard signal or operate the safety device.
The alert alarm is classified as follows:
• Input alerts ..... Upper limit input alert, lower limit input alert
• Deviation alerts..... Upper limit deviation alert, lower limit deviation alert, upper/lower limit deviation alert, within-range alert

(a) Input alerts

1) Upper limit input alert
When the process value (PV) is equal to or greater than the alert set value, the system is put in an alert status.



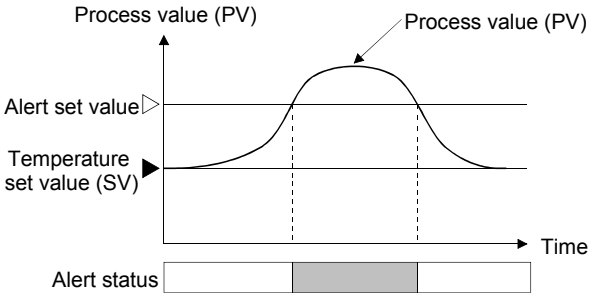
2) Lower limit input alert
When the process value (PV) is equal to or less than the alert set value, the system is put in an alert status.



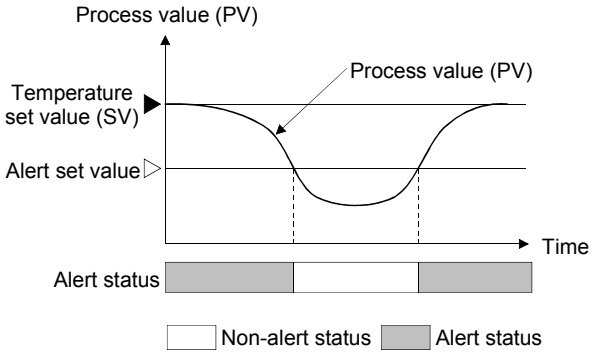
(b) Deviation alerts

1) Upper limit deviation alert
When the deviation [process value (PV) - set value (SV)] is equal to or greater than the alert set value, the system is put in an alert status.

[When alert set value is positive]

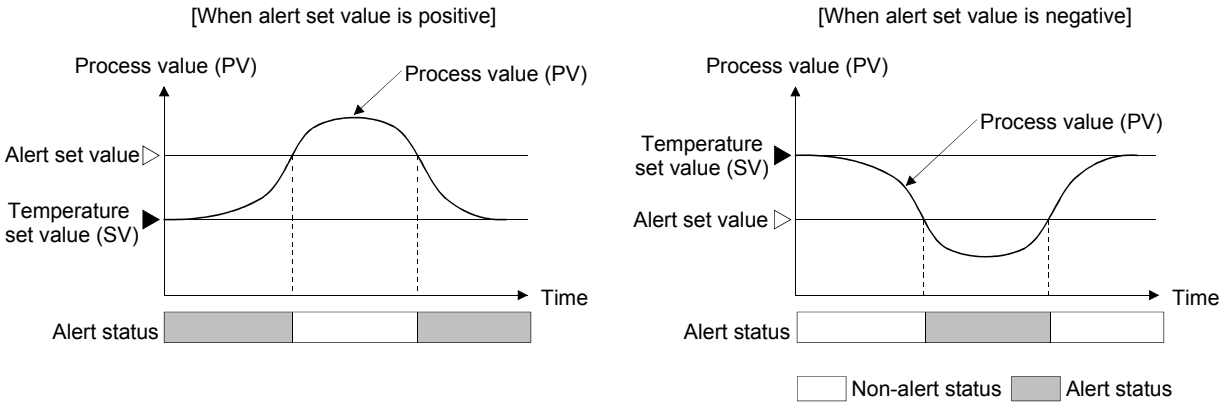


[When alert set value is negative]



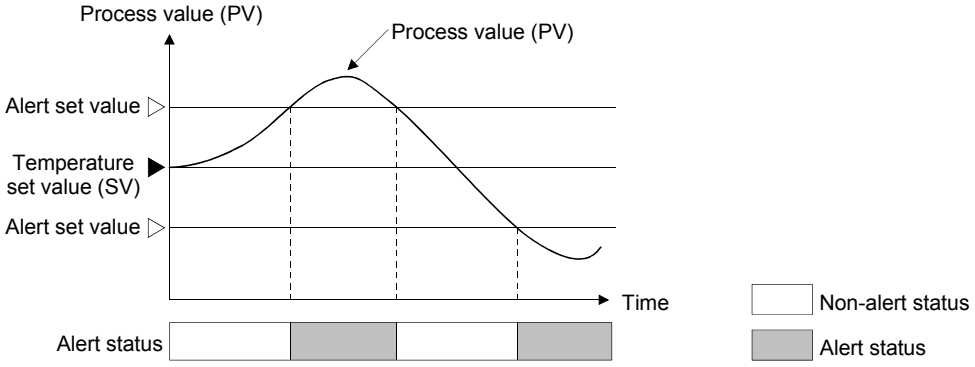
2) Lower limit deviation alert

When the deviation [process value (PV) - set value (SV)] is equal to or less than the alert set value, the system is put in an alert status.



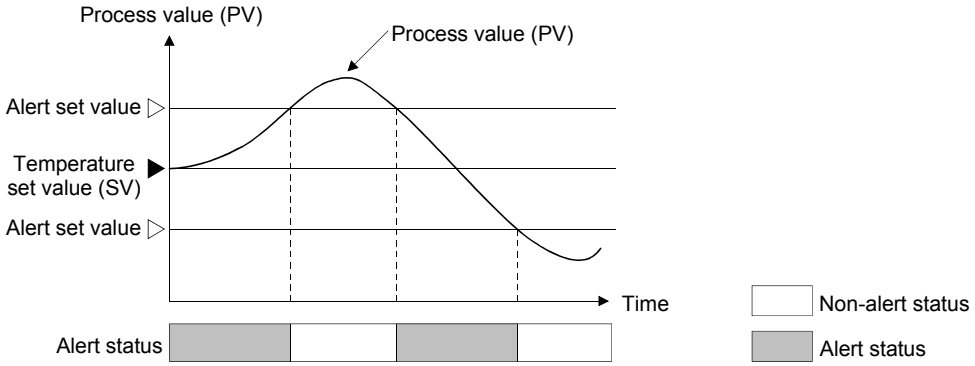
3) Upper/lower limit deviation alert

When the deviation [process value (PV) - set value (SV)] is equal to or greater than the alert set value, the system is put in an alert status.



4) Within-range alert

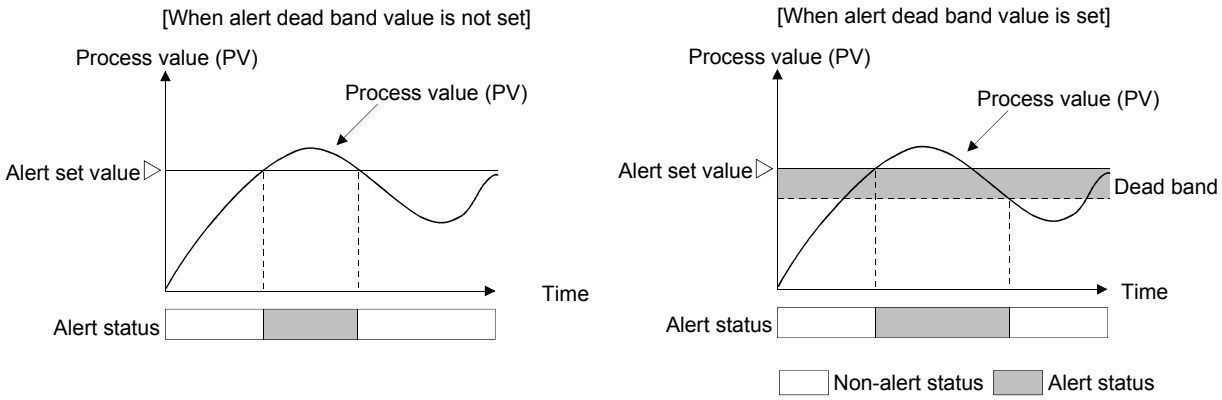
When the deviation [process value (PV) - set value (SV)] is equal to or less than the alert set value, the system is put in an alert status.



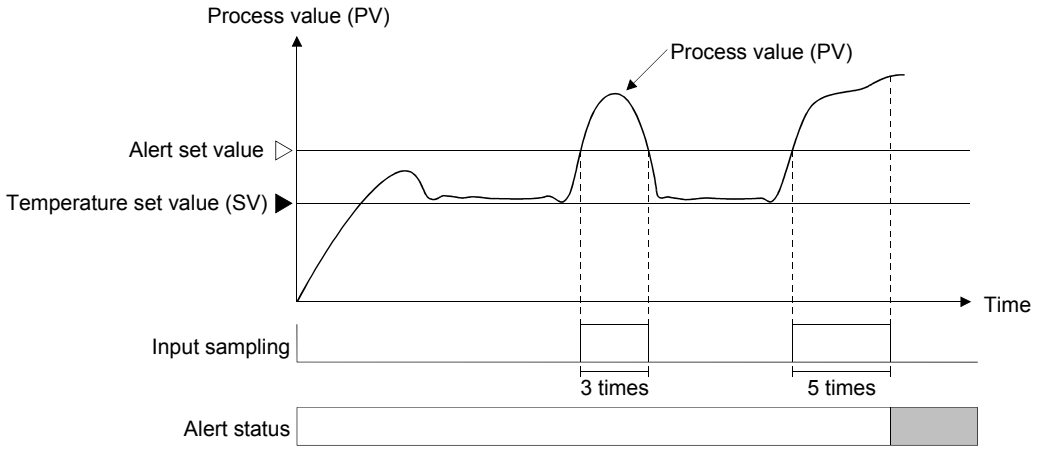
(2) The Q64TC allows the alert alarm in (1) to be set with the addition of an alert dead band, alert delay count or wait/re-wait.
The following table indicates the alert alarms which can be used with the addition of alert dead band, alert delay count and wait/re-wait.

Alert alarm		Dead band setting	Alert delay count	Wait	Re-wait
Input alert	Upper limit alert	○	○	○	—
	Lower limit alert	○	○	○	—
Deviation alert	Upper limit deviation alert	○	○	○	○
	Lower limit deviation alert	○	○	○	○
	Upper/lower limit deviation alert	○	○	○	○
	Within-range alert	○	○	—	—

(a) Alert dead band setting
When the process value (PV)/deviation is close to the alert set value, the alert status may alternate with the non-alert status due to input instability or the like. Setting the alert dead band prevents the alert status and non-alert status from alternating with each other due to input instability or the like when the process value (PV)/deviation is near the alert set value.
Example: When the dead band value is set to the upper limit input alert, the system is placed in the alert status when the upper limit of the input rises to or above the alert set value. The system is put in the non-alert status when the upper limit falls below the alert dead band.



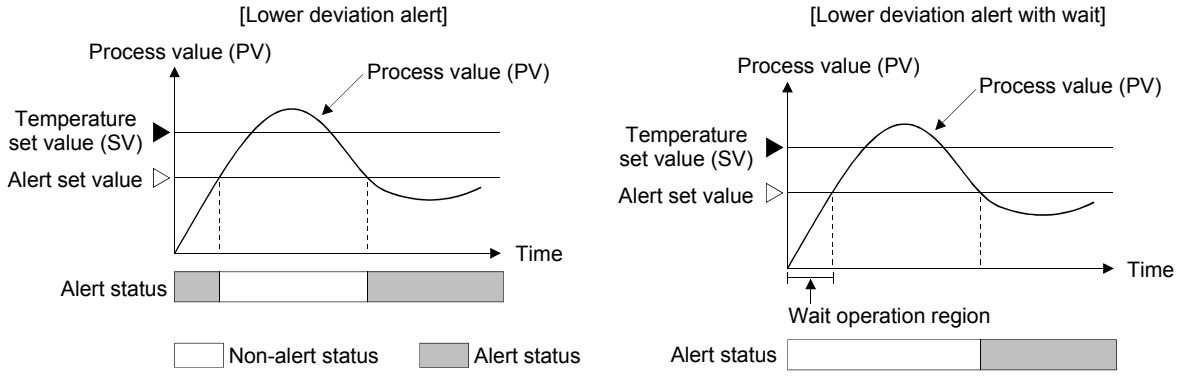
(b) Alert delay count setting
The system is set in the alert status when the process value (PV) that has reached the alert set value remains in the alert range until the sampling count becomes equal to or greater than the preset number of alert delays.
Example: When the number of alert delays set to the input upper limit alert is 5, the system is not placed in the alert status if the sampling count is 4 or less.



(c) Wait alert

Choosing the wait alert ignores the alert status if the process value (PV)/deviation is in that status when the setting mode is changed to the operation mode, and makes the alert function invalid until the process value comes out of the alert status once.

Example: Selecting the lower limit deviation alert with wait makes the alert function invalid until the process value exceeds the alert set value.



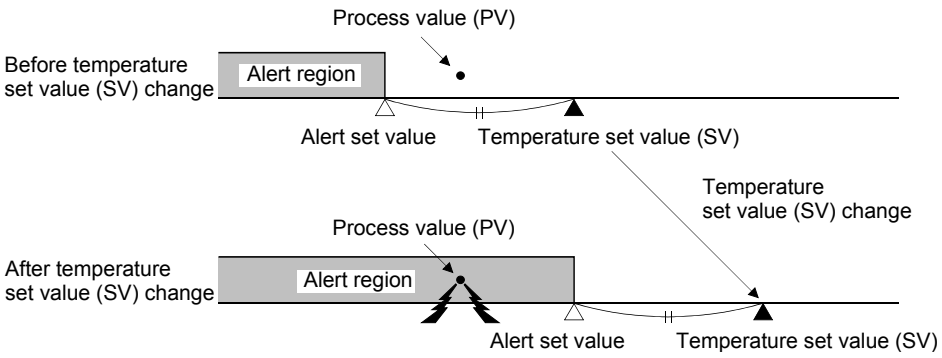
POINT

When the system has reached the non-alert status even once after an alert judgment start following the setting of the alert mode, the alert function with wait will be invalid if you choose the mode with wait.

(d) Re-wait alert

The re-wait alert is a wait alert-based feature which has the additional function to make the alert function invalid again when the set value (SV) is changed.
For set value changing control, choosing the re-wait alert avoids the alarm status reached when the set value is changed.

Example: If the process value (PV) is at the position as shown below before the setting is changed, changing the temperature set value (SV) for deviation alert will put the process value in the alert region and turn on the alert. To prevent this, the function makes the alert wait operation valid and the alert output to wait.



(3) The Q64TC allows four different alerts (alert alarms 1 to 4) to be selected and used from among the alert alarms, wait alert alarm and re-wait alert alarm. Set the alert alarms used as alert alarms 1 to 4 at the following buffer memory addresses:
- Alert alarm 1: C0H to C3H
- Alert alarm 2: D0H to D3H
- Alert alarm 3: E0H to E3H
- Alert alarm 4: F0H to F3H

(4) Set the alert set value, alert dead band value and alert delay count at the following buffer memory addresses:

Channel No.	Buffer memory addresses		
	Alert set value	Alert dead band value	Alert delay count
1	26H to 29H	A4H	A5H
2	46H to 49H		
3	66H to 69H		
4	86H to 89H		

3.2.12 Control output setting at CPU stop error occurrence

(1) You can set the Q64TC control output (HOLD/CLEAR) to be provided when the PLC CPU has generated a stop error.

(2) To make this setting, use the intelligent function module switch setting on GX Developer.
- CLEAR : Stops the PID control, temperature judgement and alert judgement functions and turns off external outputs.
- HOLD : Holds the control status prior to a PLC CPU stop. For example, when PID control was exercised before a PLC CPU stop, PID control is continued if the PLC CPU stops.

Refer to Section 4.5 for details of the setting method.

3.2.13 Q64TC control status controlling output signal and buffer memory settings and control status

The Q64TC has the output signals (Y), buffer memory and intelligent function module switch which set its control status.
The control status of the Q64TC is governed as indicated below by the settings of the output signals, buffer memory and intelligent function module switch.

(1) Intelligent function module switch setting

Output setting for CPU stop error (refer to Section 4.5) / Intelligent function module switch	Control status		
	PID control	Temperature judgment	Alert judgment
If a CPU stop error occurs at the setting of "CLEAR"	—	—	—
Other than above	In accordance with control status of other setting items		

○: Executed, —: Not executed

(2) Unused channel setting

Unused channel setting (refer to Section 3.5.33) / $3D_H$, $5D_H$, $7D_H$, $9D_H$	Control status		
	PID control	Temperature judgment	Alert judgment
Unused	—	—	—
Used	In accordance with control status of other setting items		

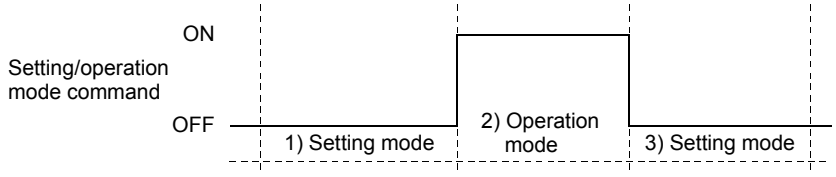
○: Executed, —: Not executed

(3) Other settings

Setting/operation mode command (refer to Section 3.4)*	PID continuation flag (refer to Section 3.5.41)	Forced PID control stop command (refer to Section 3.4.3)	Stop mode setting (refer to Section 3.5.13)	Control status		
				PID control	Temperature judgment	Alert judgment
Yn1, Xn1	$A9_H$	YnC to YnF	21_H, 41_H, 61_H, 81_H			
1) Setting mode (at power-on)	Stop/continue	OFF/ON	Stop	—	—	—
			Monitor	—	○	—
			Alert	—	○	○
2) Operation mode (during operation)	Stop/continue	OFF	Stop/monitor/alert	○	○	○
		ON	Stop	—	—	—
			Monitor	—	○	—
			Alert	—	○	○
3) Setting mode (after operation)	Stop	OFF/ON	Stop	—	—	—
			Monitor	—	○	—
			Alert	—	○	○
	Continue	OFF	Stop/monitor/alert	○	○	○
		ON	Stop	—	—	—
			Monitor	—	○	—
			Alert	—	○	○

○: Executed, —: Not executed

*: The settings of the setting/operation mode command will be explained in the following three different modes.

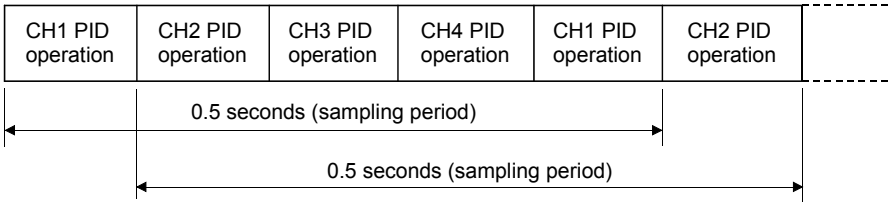


3.3 Sampling Period and Control Output Period

(1) Sampling period

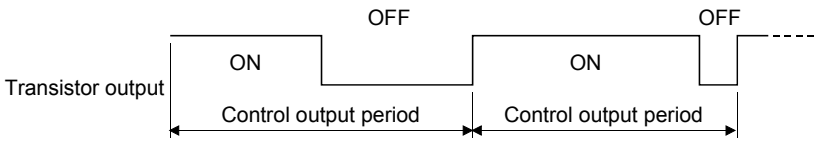
(a) The Q64TC performs PID operations in order of CH1, CH2, CH3, CH4, CH1, CH2 .....
The time from when PID operation is started on the current channel (CHn) until PID operation is restarted on the current channel (CHn) is called a sampling period.

(b) The sampling period is 0.5 seconds regardless of the number of channels used.
Since error check and other processings are also performed on unused channels, the sampling period will not change if you make unused channel setting.



(2) Control output period

(a) The control output period indicates the ON/OFF cycle of transistor output.



The manipulated value (MV) represents the ON time of this control output period as a percentage. (Refer to Section 3.5.6)

(b) Set the control output period to the control output period setting buffer memory ($2F_H$, $4F_H$, $6F_H$, $8F_H$) in the range 1 to 100s.

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3.4 I/O Signals Transferred to/from the PLC CPU

This section explains the allocation and applications of the Q64TC I/O signals.

3.4.1 I/O signal list

(1) The Q64TC uses 16 input points and 16 output points to transfer signals to/from the PLC CPU.

(2) Table 3.4 lists the I/O signals used by the Q64TC.
Inputs (X) mean the signals from the Q64TC to the PLC CPU and outputs (Y) the signals from the PLC CPU to the Q64TC.

(3) The I/O signals (X, Y) indicated in this manual assume that the module is loaded on the I/O slot 0 of the main base unit.
If the Q64TC is mounted on other than the I/O slot 0, change the I/O signals for those of the slot where the module is mounted.

(4) When the Q64TCTTBW or Q64TCRTBW is used, the device numbers of the I/O signals increase by 16 points depending on how many free points the left-hand side slots have.
Hence, as I/O signals are given as indicated below in this manual, read them according to the module used.
Example) When a signal is given as Yn1
When Q64TCTT or Q64TCRT is used: Y1
When Q64TCTTBW or Q64TCRTBW is used: Y11

Table 3.4 I/O signal list

Input signal (Signal direction: Q64TC → PLC CPU)		Output signal (Signal direction: Q64TC ← PLC CPU)	
Device No.	Signal name	Device No.	Signal name
Xn0	Module ready flag	Yn0	Reserved
Xn1	Setting/operation mode status	Yn1	Setting/operation mode command
Xn2	Write error flag	Yn2	Error reset command
Xn3	Hardware error flag	Yn3	Reserved
Xn4	CH1 auto tuning status	Yn4	CH1 auto tuning command
Xn5	CH2 auto tuning status	Yn5	CH2 auto tuning command
Xn6	CH3 auto tuning status	Yn6	CH3 auto tuning command
Xn7	CH4 auto tuning status	Yn7	CH4 auto tuning command
Xn8	E^2PROM write completion flag	Yn8	E^2PROM backup command
Xn9	Default value write completion flag	Yn9	Default setting registration command
XnA	E^2PROM write failure flag	YnA	Reserved
XnB	Setting change completion flag	YnB	Setting change command
XnC	CH1 alert occurrence flag	YnC	CH1 forced PID control stop command
XnD	CH2 alert occurrence flag	YnD	CH2 forced PID control stop command
XnE	CH3 alert occurrence flag	YnE	CH3 forced PID control stop command
XnF	CH4 alert occurrence flag	YnF	CH4 forced PID control stop command

POINT

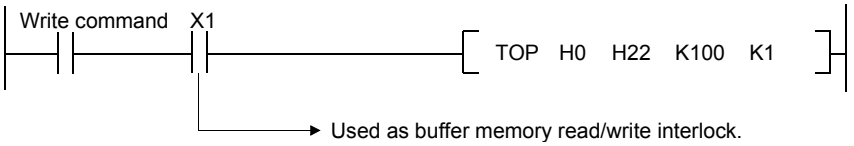
We cannot guarantee the functions of the Q64TC if any of the reserved areas is turned on/off in a sequence program.

3.4.2 Input signal functions

(1) Module ready flag (Xn0)

(a) This signal turns on as soon as the Q64TC is ready when the PLC CPU is powered on or reset.

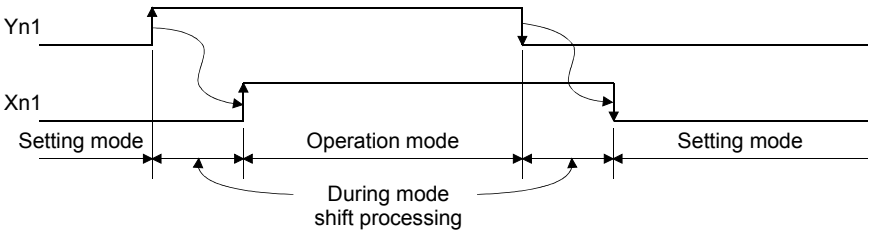
(b) Read/write of Q64TC buffer memory data from the PLC CPU is performed when the temperature control module ready flag is on.



(c) This signal turns off on detection of a watchdog timer error. The Q64TC stops temperature control operation and turns off the output.

(2) Setting/operation mode status (Xn1)

This signal turns on in the operation mode and turns off in the setting mode.
Do not change the set value during mode shift processing.



(3) Write error flag (Xn2)

This signal turns on at write error occurrence.
A write error occurs under any of the following conditions.

- When data is set to the reserved area.
- When a setting change made to the area write-enabled in the setting mode only is made in the operation mode.
- When data outside the setting range is set.
- When data setting is changed during default setting registration.

(4) Hardware (H/W) error flag (Xn3)

This signal turns on when the temperature control module results in a hardware error.

(5) Auto tuning status flag (Xn4 to Xn7)

(a) This signal turns on when auto tuning of the corresponding channel is executed.

Channel	Auto tuning status flag	ON/OFF status
1	Xn4	ON : Auto tuning in execution OFF: Auto tuning not in execution or completed
2	Xn5	
3	Xn6	
4	Xn7	

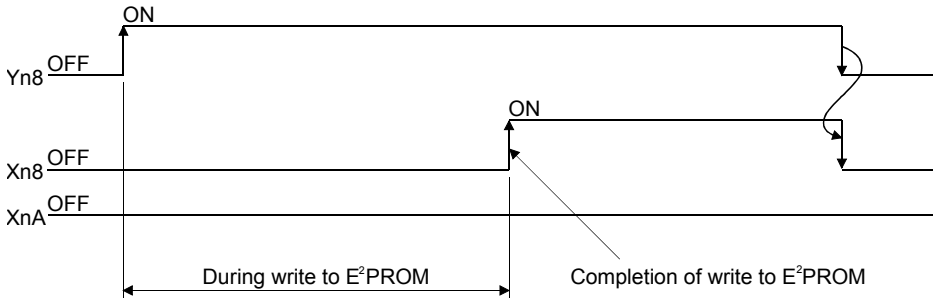
(b) Auto tuning is executed using the auto tuning command (Yn4 to Yn7).

(c) This signal turns "on" while auto tuning is being executed and turns "off" automatically on completion of auto tuning.

(6) E^2PROM write completion flag (Xn8)

(a) This signal turns on after completion of write of buffer memory contents to E^2PROM which starts when the E^2PROM backup command (Yn8) turns on.

(b) When the E^2PROM backup command turns off, the E^2PROM write completion flag also turns off.



(7) Default value write completion flag (Xn9)

(a) Turns on after completion of write of Q64TC default values to buffer memory which starts when the default setting registration command (Yn9) turns on.

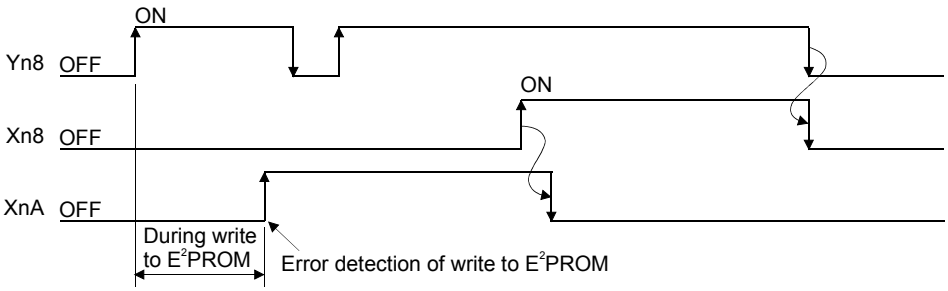
(b) When the default setting registration command (Yn9) turns off, the default value write completion flag (Xn9) also turns off.

(c) Perform unused channel setting to unused channels after completion of default value write.
If unused channel setting is not made to unused channels, the "ALM" LED of the Q64TC is lit.

(8) E^2PROM write failure flag (XnA)

(a) This signal turns on at a failure of write of buffer memory contents to E^2PROM which starts when the E^2PROM backup command (Yn8) turns on.

- OFF : Completion of write to E^2PROM
- ON : Failure of write to E^2PROM (Write could not be completed normally)



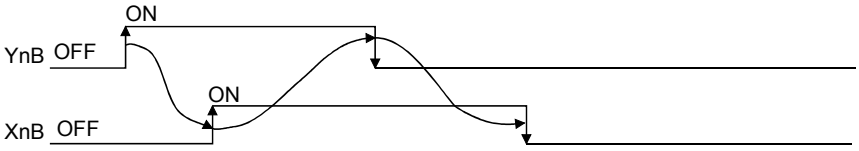
(b) The E^2PROM write failure flag turns off at normal completion of write to E^2PROM.

(c) When the E^2PROM write failure flag has turned on, the E^2PROM contents are undefined.
Hence, powering on the PLC CPU again or resetting it with the E^2PROM write failure flag on will make the buffer memory contents undefined, causing the Q64TC to operate with the default values.

(9) Setting change completion flag (XnB)

(a) This signal turns on after completion of reflection of buffer memory settings on control which starts when the setting conversion command (YnB) turns on.

(b) When the setting change command (YnB) turns off, the setting change completion flag also turns off.

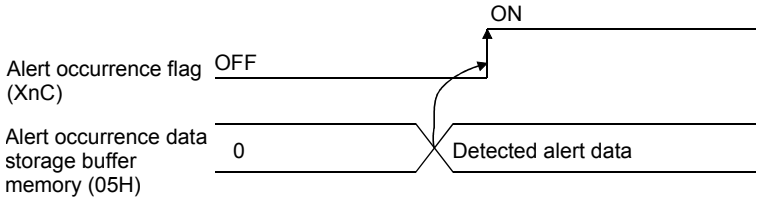


(10) Alert occurrence flag (XnC to XnF)

(a) This signal turns on at alarm occurrence on the corresponding channel.

Channel	Alert occurrence flag	ON/OFF status	Alert occurrence data storage buffer memory address
1	XnC	OFF: Without alarm occurrence ON : With alarm occurrence	5H
2	XnD		6H
3	XnE		7H
4	XnF		8H

(b) When an alert occurs, the alert occurrence data is stored into buffer memory (05H to 08H) and the alert occurrence flag turns on.



3.4.3 Output signal functions

(1) Setting mode/operation mode command (Yn1)

(a) This signal is used to set the operation mode of the temperature control function.
- OFF : Setting mode
- ON : Operation mode

(b) This signal is set to all 4 channels together.

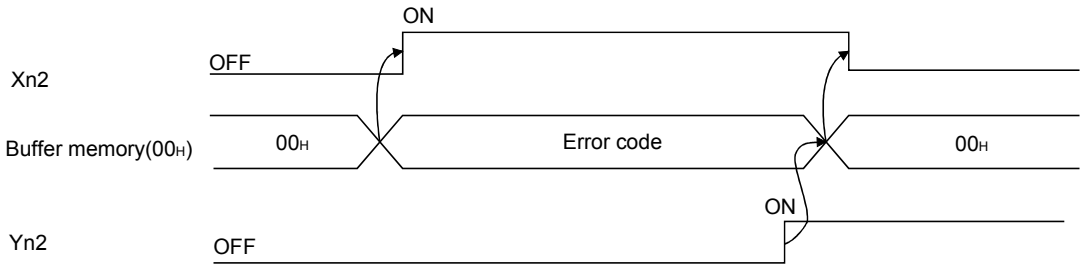
(c) The following setting items may be changed only when Yn1 is off.
- Input range (20H, 40H, 60H, 80H)
- Alert 1 to 4 mode setting (C0H to C3H, D0H to D3H, E0H to E3H, F0H to F3H)

A write data error (error code 3) will occur if any of these items is changed in the operation mode.

(d) Refer to Section 3.2.13 for the Q64TC operation governed by ON/OFF of the setting mode/operation mode command.

(2) Error reset command (Yn2)

This signal is used to turn off the write error flag (Xn2) and clear (reset) the write data error code storage buffer memory.



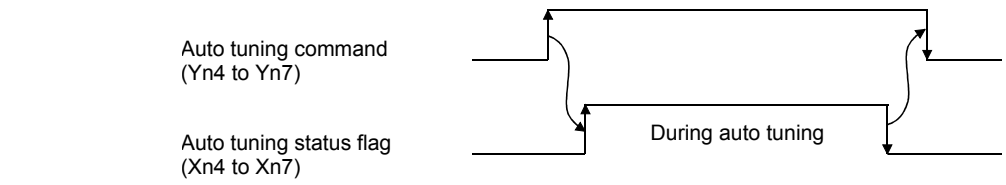
(3) Auto tuning command (Yn4 to Yn7)

(a) This signal is used to start auto tuning.

(b) Turning on the auto tuning command (Yn4 to Yn7) starts auto tuning and turns on the auto tuning status flag (Xn4 to Xn7).
When auto tuning is completed, the auto tuning status flag (Xn4 to Xn7) turns off.

(c) Keep the auto tuning command on while auto tuning is in execution, and turn it off on completion of auto tuning.

(d) Turning off the auto tuning command during auto tuning execution stops auto tuning.
When auto tuning is stopped, the PID constants in buffer memory do not change.



(e) Auto tuning is not performed when the proportional band (P) setting buffer memory (23H, 43H, 63H, 83H) setting is 0.

(4) E^2PROM backup command (Yn8)

(a) This signal is used to write buffer memory contents to E^2PROM.

(b) Turning on the E^2PROM backup command writes buffer memory contents to E^2PROM.

1) The "E^2PROM write completion flag (Xn8)" turns on at normal completion of write.

2) If write to E^2PROM is not completed normally, the "E^2PROM write failure flag (XnA)" turns on.
If XA has turned on, turn on the E^2PROM backup command again to write data to E^2PROM.

POINT

The number of writes to E^2PROM is up to 100,000 times.
When setting the PID constants, etc. at a PLC CPU startup, reduce the number of writes by avoiding write to E^2PROM, for example.

(5) Default setting registration command (Yn9)

(a) This signal is used to return buffer memory contents to default values.
Turning on the default setting registration command writes the default values of the Q64TC to buffer memory and the default value write completion flag (Xn9) turns on at its completion.

(b) Make default setting in the setting mode (Xn1: OFF).
You cannot make default setting in the operation mode (Yn1: ON).

(6) Setting change command (YnB)

(a) This signal is used to determine the following buffer memory contents as set values.
- Input range setting (20_H, 40_H, 60_H, 80_H)
- Alert 1 to 4 mode setting ($C0_H$ to $C3_H$, $D0_H$ to $D3_H$, $E0_H$ to $E3_H$, $F0_H$ to $F3_H$)

(b) For the setting items indicated in (a), their set values are not reflected on the module operation if they are written to the corresponding buffer memory addresses. To determine them as set values, this device must be turned on after the values are written to buffer memory.

(c) Turning on the setting change command starts the operation as set in the corresponding buffer memory address. The setting change completion flag (XnB) turns on at completion of the setting change.
For setting items other than the above, their set values are determined by merely writing values to the buffer memory.

(d) This device is usable as an interlock for the setting/operation mode command (Yn1).

(7) Forced PID control stop command (YnC to YnF)

(a) This signal is used to stop the PID operation of the corresponding channel forcibly.

(b) The mode in which PID operation stops is governed by the stop mode setting buffer memory (21_H, 41_H, 61_H, 81_H) setting.

3.5 Buffer Memory

3.5.1 Buffer memory list

(1) Buffer memory common to Q64TCs

Addresses (Hexadecimal) CH1	CH2	CH3	CH4	Settings		Range	Initial value	Read/write
0H				Write data error code		—	—	Read only
1H	2H	3H	4H	Decimal point position	Q64TCTT(BW)	—	0	Read only
					Q64TCRT(BW)	—	1	
5H	6H	7H	8H	Alert definition		—	—	Read only
9H	AH	BH	CH	Temperature process value (PV)		—	—	Read only
DH	EH	FH	10H	Manipulated value (MV)		—	—	Read only
11H	12H	13H	14H	Temperature rise judgment flag		—	—	Read only
15H	16H	17H	18H	Transistor output flag		—	—	Read only
19H	1AH	1BH	1CH	Reserved		—	—	—
1DH				Q64TCTT(BW)	Cold junction temperature process value	—	—	Read only
				Q64TCRT(BW)	Reserved			—
1EH				MAN mode shift completion flag		—	—	Read only
1FH				E^2PROM's PID constant read/write completion flag		—	—	Read only
20H	40H	60H	80H	Input range*	Q64TCTT(BW)	Refer to Section 3.5.12.	2	Read/write enabled
					Q64TCRT(BW)		7	
21H	41H	61H	81H	Stop mode setting		0: Stop,1: Monitor,2: Warning	1	Read/write enabled
22H	42H	62H	82H	Set value (SV) setting		In accordance with input range setting	0	Read/write enabled
23H	43H	63H	83H	Proportional band (P) setting		0 to 10000(0.0 to 1000.0%)	30	Read/write enabled
24H	44H	64H	84H	Integral time (I) setting		1 to 3600(s)	240	Read/write enabled
25H	45H	65H	85H	Derivative time (D) setting		0 to 3600(s)	60	Read/write enabled
26H	46H	66H	86H	Alert set value 1		In accordance with alert mode setting and input range setting	0	Read/write enabled
27H	47H	67H	87H	Alert set value 2				
28H	48H	68H	88H	Alert set value 3				
29H	49H	69H	89H	Alert set value 4				
2AH	4AH	6AH	8AH	Upper output limiter		-50 to 1050(-5.0 to 105.0%)	1000	Read/write enabled
2BH	4BH	6BH	8BH	Lower output limiter			0	Read/write enabled
2CH	4CH	6CH	8CH	Output variation limiter		0 to 1000(0.0 to 100.0%/s)	0	Read/write enabled
2DH	4DH	6DH	8DH	Sensor compensation value setting		-5000 to 5000 (-50.00 to 50.00%)	0	Read/write enabled
2EH	4EH	6EH	8EH	Adjustment sensitivity (dead band) setting		1 to 100(0.1 to 10.0%)	5	Read/write enabled
2FH	4FH	6FH	8FH	Control output period setting		1 to 100(s)	30	Read/write enabled
30H	50H	70H	90H	Primary delay digital filter setting		0 to 100(s)	0	Read/write enabled
31H	51H	71H	91H	Control response parameter		0: Slow, 1: Normal, 2: Fast	0	Read/write enabled
32H	52H	72H	92H	AUTO/MAN mode switching		0: Auto (AUTO), 1: Manual (MAN)	0	Read/write enabled
33H	53H	73H	93H	MAN output setting		-50 to 1050 (-5.0% to 105.0%)	0	Read/write enabled
34H	54H	74H	94H	Setting change rate limiter		0 to 1000 (0.0 to 100.0%/min)	0	Read/write enabled
35H	55H	75H	95H	AT bias		±input range width	0	Read/write enabled
36H	56H	76H	96H	Forward/reverse action setting		0: Forward action, 1: Reverse action	1	Read/write enabled
37H	57H	77H	97H	Upper setting limiter	Q64TCTT(BW)	Within measurement range	1300	Read/write enabled
					Q64TCRT(BW)		6000	
38H	58H	78H	98H	Lower setting limiter	Q64TCTT(BW)		0	Read/write enabled
					Q64TCRT(BW)		-2000	

*: This setting may be changed only in the setting mode. Note that changing it in the operation mode will result in a write data error. Also, the setting change command (YnB) must be turned on to change the setting.

Addresses (Hexadecimal)				Settings	Range	Initial value	Read/write
CH1	CH2	CH3	CH4				
39H	59H	79H	99H	Reserved	—	—	—
3AH	5AH	7AH	9AH	Heater disconnection alert setting	0 to 100%	0	Read/write enabled
3BH	5BH	7BH	9BH	Loop disconnection detection judgment time	0 to 7200s	480	Read/write enabled
3CH	5CH	7CH	9CH	Loop disconnection detection dead band	Input range width	0	Read/write enabled
3DH	5DH	7DH	9DH	Unused channel setting	0: Used, 1: Unused	0	Read/write enabled
3EH	5EH	7EH	9EH	E^2PROM's PID constant read command	0: Without command, 1: With command	0	Read/write enabled
3FH	5FH	7FH	9FH	Automatic backup setting after auto tuning of PID constants	0: OFF, 1: ON	0	Read/write enabled
A0H				Reserved	—	—	—
A1H				Reserved			
A2H				Reserved			
A3H				Reserved			
A4H				Alert dead band setting	0 to 100(0.0 to 10.0%)	5	Read/write enabled
A5H				Alert delay count	0 to 255 (times)	0	Read/write enabled
A6H				Heater disconnection/output off-time current error detection delay count	3 to 255 (times)	3	Read/write enabled
A7H				Temperature rise completion range setting	1 to 10 (°C)	1	Read/write enabled
A8H				Temperature rise completion soak time setting	0 to 3600 (min)	0	Read/write enabled
A9H				PID continuation flag	0: Stop, 1: Continue	0	Read/write enabled
AAH				Heater disconnection compensation function selection	0: OFF, 1: ON	0	Read/write enabled
ABH	ACH	ADH	AEH	Reserved	—	—	—
AFH				Transistor output monitor ON delay time setting	0 to 50(0 to 500ms)	0	Read/write enabled
B0H				CT monitor method switching	0: ON/OFF current, 1: ON current	0	Read/write enabled
B1H	B2H	B3H	B4H	Manipulated value (MV)	0 to4000, 0 to 12000, 0 to 16000	—	Read only
B5H				Manipulated value resolution switching	0: 0 to 4000,1: 0 to 12000, 3: 0 to16000	0	Read/write enabled
B8H	B9H	BAH	BBH	Auto tuning mode selection	0: Standard mode 1: Fast response mode	0	Read/write enabled
C0H	D0H	E0H	F0H	Alert 1 mode setting ✻	0 to 14	0	Read/write enabled
C1H	D1H	E1H	F1H	Alert 2 mode setting ✻			
C2H	D2H	E2H	F2H	Alert 3 mode setting ✻			
C3H	D3H	E3H	F3H	Alert 4 mode setting ✻			

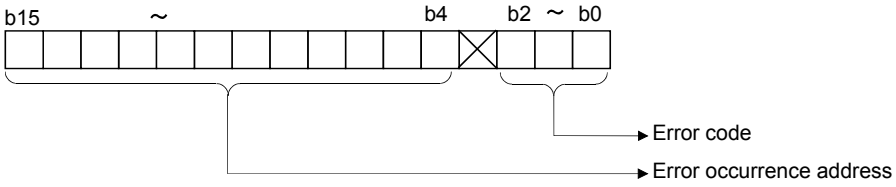
✻: This setting may be changed only in the setting mode. Note that changing it in the operation mode will result in a write data error. Also, the setting change command (YnB) must be turned on to change the setting.

(2) Q64TCTTBW, Q64TCRTBW-dedicated buffer memory

Addresses (Hexadecimal)								Settings	Range	Initial value	Read/write
CT1	CT2	CT3	CT4	CT5	CT6	CT7	CT8				
100H	101H	102H	103H	104H	105H	106H	107H	Heater current process value	—	—	Read only
108H	109H	10AH	10BH	10CH	10DH	10EH	10FH	CT input channel assignment setting	0:Unused, 1:CH1, 2:CH2,3:CH3,4:CH4	0	Read/write enabled
110H	111H	112H	113H	114H	115H	116H	117H	CT selection	0: 0 to 1000 (0.0 to 100.0(A)) 1: 0 to 2000 (0.00 to 20.00(A))	0	Read/write enabled
118H	119H	11AH	11BH	11CH	11DH	11EH	11FH	Reference heater current value	Heater current range (×0.1A / ×0.01A)	0	Read/write enabled

3.5.2 Write data error code (buffer memory address: 0H)

Stores the error code and error-detected buffer memory address of the error detected when write from PLC CPU to Q64TC buffer memory was performed.



(1) When data is written from the PLC CPU, the Q64TC checks:
- Whether write destination is read-only area or not
- Whether write destination is reserved area or not
- Whether write data range is proper or not

(2) The following processings are performed at write error occurrence.
- Error code is stored (refer to Section 8.1 for error code details).
- Write error occurrence flag (Xn2) turns on.

(3) If more than one error has occurred, the error code and error occurrence address of the error having the highest priority are stored. (Refer to Section 8.2 for details of processing at error occurrence.)

(4) Refer to Section 8.1 for error resetting.

3.5.3 Decimal point position (buffer memory address: 1H to 4H)

(1) The decimal point position for the following data is stored according to the input range setting which determines the measured temperature range.
- Temperature process value (PV)
- Set value (SV)
- Alert set value

"1" is stored if the input range of the measured temperature range with a decimal point was set.
"0" is stored if the input range of the measured temperature range without a decimal point was set.

(2) Refer to the following table when performing write/read of the above data from the PLC CPU.

Decimal point position	For read	For write
0	Buffer memory data is read as is and used in sequence programs, etc.	The specified value is written as is.
1	One/tenth of the value read from a sequence program or the like is used as the actual value.	The value 10 times the specified value is written.

3.5.4 Alert definition (buffer memory address: 5H to 8H)

(1) The bit associated with the alert detected on the corresponding channel turns to "1".

Associated bit number	Alert definition
b0	PV rose above the temperature measurement range* of the preset input range.
b1	PV fell below the temperature measurement range* of the preset input range.
b2 to b7	Unused
b8	Alert 1 turned on.
b9	Alert 2 turned on.
b10	Alert 3 turned on.
b11	Alert 4 turned on.
b12	Heater disconnection was detected.
b13	Loop disconnection was detected.
b14	Output off-time current error was detected.
b15	Unused

*: The temperature measurement range represents the range from the lower limit of -5% to the upper limit of +5% relative to the full-scale of the input range.
Example) Input range 38
Input range : -200.0 to 400.0
Temperature measurement range : -230.0 to 430.0
(An alert occurs at the temperature of lower than -230.0°C or higher than 430.0°C.)

3.5.5 Temperature process value (PV value, buffer memory address: 9H to CH)

(1) Stores the Q64TC-detected value on which the following processings have been performed:
• Linearization
• Sensor compensation

(2) The value stored varies with the decimal point position (buffer memory address: 1H to 4H) as indicated below:
• If the decimal point position is 0, the value is stored as is.
• If the decimal point position is 1, 10 times that value is stored.

POINT

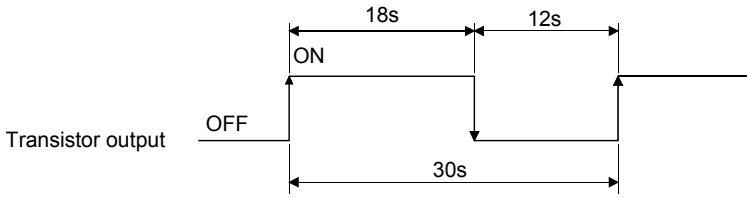
The following value is stored if the temperature detected by the temperature sensor falls outside the temperature measurement range:
• If the value is higher than the temperature measurement range: +5% of the (input range upper limit)
• If the value is lower than the temperature measurement range: -5% of the (input range upper limit)

3.5.6 Manipulated value (MV value, buffer memory address: DH to 10H)

(1) Stores the result of PID operation performed on the basis of the temperature value imported from the temperature sensor.

(2) The value stored is in the range -50 to 1050 (-5.0% to 105.0%).
However, the value is in the range 0% to 100% for external output.
• Less than 0% : 0%
• More than 100% : 100%

(3) The manipulated value represents the ON time of the control output period (buffer memory address: 2FH, 4FH, 6FH, 8FH) as a percentage.
At the control output period of 30s (seconds) and the manipulated value of 600 (60.0%), the pulse turns on for 18 seconds and turns off for 12 seconds.



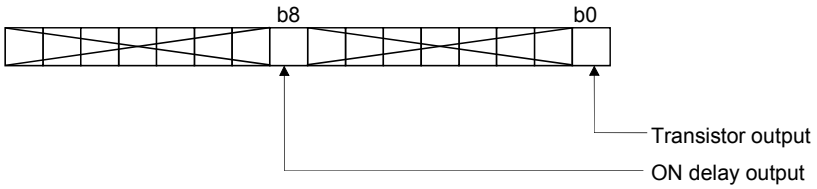
3.5.7 Temperature rise judgment flag (buffer memory address: 11H to 14H)

(1) This flag checks whether the temperature process value (PV) is within the temperature rise completion range or not.

(2) This flag turns to "1" when the temperature process value (PV) is within the temperature rise completion range.
Setting the temperature rise completion soak time (buffer memory address: A8H) will cause this flag to turn to "1" when the temperature process value remains within the temperature rise completion range of the preset temperature rise completion soak time.

3.5.8 Transistor output flag (buffer memory address: 15H to 18H)

(1) Stores the ON/OFF statuses of the transistor output and ON delay output.



(2) The following values are stored as the ON/OFF statuses of the transistor output and ON delay output.
• ON : 1
• OFF : 0

3.5.9 Cold junction temperature process value (buffer memory address: 1DH)

(1) Stores the measured temperature (0 to 55°C) of the cold junction temperature compensation resistor fitted to the Q64TCTT(BW).

3.5.10 MAN mode shift completion flag (buffer memory address: 1EH)

(1) This flag checks whether switching from the automatic mode (AUTO) to the manual mode (MAN) has been completed or not.
The bit associated with the corresponding channel turns to "1" on completion of switching to the manual mode.
• Channel 1: Bit 0 (b0)
• Channel 2: Bit 1 (b1)
• Channel 3: Bit 2 (b2)
• Channel 4: Bit 3 (b3)

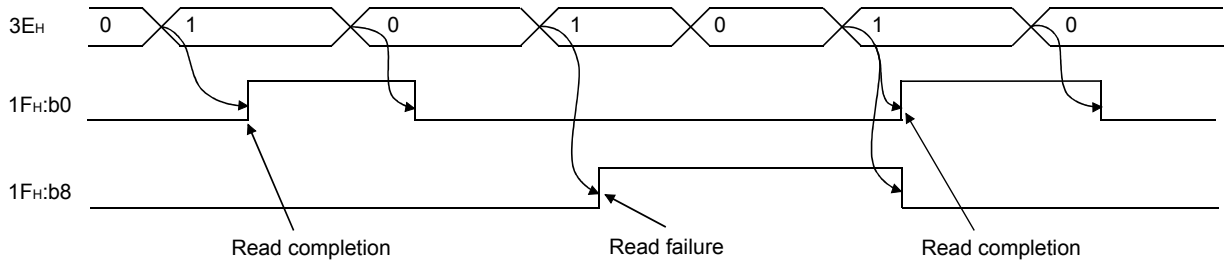
(2) When setting the manipulated value (MV) in the manual mode, make setting after confirming that the manual mode shift completion flag has turned to "1".

3.5.11 E^2PROM's PID constant read/write flag (buffer memory address: 1FH)

(1) This flag indicates a normal completion or failure of the following functions.
• E2PROM's PID constant read command
• Automatic backup setting after auto tuning of PID constants
The following table indicates the definitions of the bits.

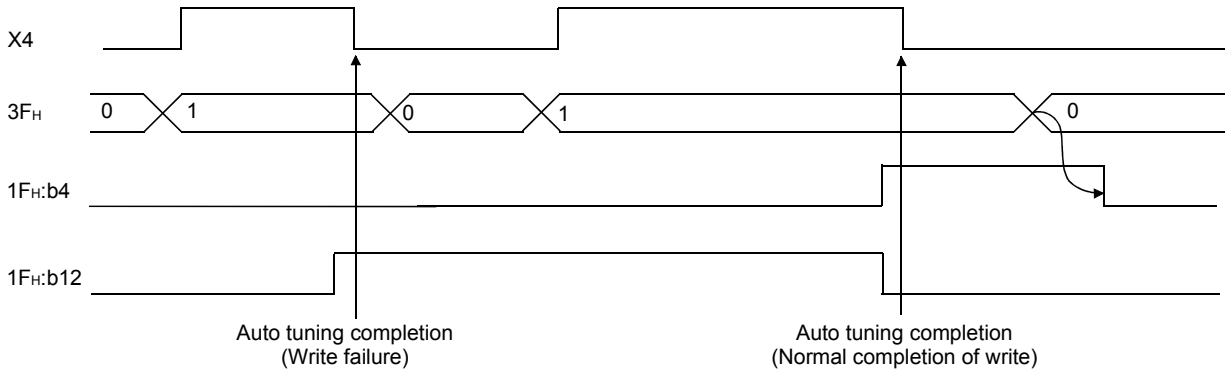
Bit number	Flag definition	Bit number	Flag definition
b0	Channel 1 read completion	b8	Channel 1 read failure
b1	Channel 2 read completion	b9	Channel 2 read failure
b2	Channel 3 read completion	b10	Channel 3 read failure
b3	Channel 4 read completion	b11	Channel 4 read failure
b4	Channel 1 write completion	b12	Channel 1 write failure
b5	Channel 2 write completion	b13	Channel 2 write failure
b6	Channel 3 write completion	b14	Channel 3 write failure
b7	Channel 4 write completion	b15	Channel 4 write failure

(2) The following chart shows the ON/OFF timings of this flag relative to the E^2PROM's PID constant read command (3EH, 5EH, 7EH, 9EH). (For channel 1)



The read failure flag (b8 to b11) turns off on normal completion of read on the corresponding channel.

(3) The following chart shows the ON/OFF timings of this flag relative to the automatic backup setting after auto tuning of PID constants (3EH, 5EH, 7EH, 9EH).
(For channel 1)



Browsing this flag on completion of auto tuning allows you to check whether automatic backup was completed normally or failed.
The write failure flag (b11 to b15) turns off on normal completion of write on the corresponding channel.

3.5.12 Input range (buffer memory address: 20H, 40H, 60H, 80H)

(1) The following table indicates the types and input range settings of the temperature sensors to be connected to the Q64TC.
Set the input range setting value according to the temperature sensor and operating temperature range used.
Always set the input range in the setting mode (Yn1: OFF).

(a) For use of Q64TCTT(BW)

Thermocouple type	°C			°F		
	Measured temperature range	Input range setting	Setting increments	Measured temperature range	Input range setting	Setting increments
R	0 to 1700	1	1	0 to 3000	105	1
K	0 to 500	11	1	0 to 1000	100	1
	0 to 800	12	1	0 to 2400	101	1
	0 to 1300	2	1	0.0 to 1000.0	130	0.1
	-200.0 to 400.0	38	0.1	—	—	—
	0.0 to 400.0	36	0.1			
	0.0 to 500.0	40	0.1			
	0.0 to 800.0	41	0.1			
J	0 to 500	13	1	0 to 1000	102	1
	0 to 800	14	1	0 to 1600	103	1
	0 to 1200	3	1	0 to 2100	104	1
	0.0 to 400.0	37	0.1	0.0 to 1000.0	131	0.1
	0.0 to 500.0	42	0.1	—	—	—
	0.0 to 800.0	43	0.1			
T	-200 to 400	4	1	0 to 700	109	1
	-200 to 200	21	1	-300 to 400	110	1
	0 to 200	19	1	0.0 to 700.0	132	0.1
	0 to 400	20	1	—	—	—
	-200.0 to 400.0	39	0.1			
	0.0 to 400.0	45	0.1			
S	0 to 1700	15	1	0 to 3000	106	1
B	0 to 1800	16	1	0 to 3000	107	1
E	0 to 400	17	1	0 to 1800	108	1
	0 to 1000	18	1	—	—	—
	0.0 to 700.0	44	0.1			
N	0 to 1300	22	1	0 to 2300	111	1
U	0 to 400	25	1	0 to 700	114	1
	-200 to 200	26	1	-300 to 400	115	1
	0.0 to 600.0	46	0.1	—	—	—
L	0 to 400	27	1	0 to 800	116	1
	0 to 900	28	1	0 to 1600	117	1
	0.0 to 400.0	47	0.1	—	—	—
	0.0 to 900.0	48	0.1			
PL II	0 to 1200	23	1	0 to 2300	112	1
Wre5-26	0 to 2300	24	1	0 to 3000	113	1

(b) For use of Q64TCRT(BW)

Platinum temperature-measuring resistor type	°C		°F	
	Measured temperature range	Input range setting	Measured temperature range	Input range setting
Pt100	-200.0 to 600.0	7	-300 to 1100	141
	-200.0 to 200.0	8	-300.0 to 300.0	143
JPt100	-200.0 to 500.0	5	-300 to 900	140
	-200.0 to 200.0	6	-300.0 to 300.0	142

(2) After the input range setting is changed, the temperature measurement value turns to "0" for about 8 seconds.

(3) When changing the input range, make setting so that the upper and lower setting limiter values are within the temperature measurement range.

(4) To determine the set value change, you must turn on the setting change command (YnB).

3.5.13 Stop mode setting (buffer memory address: 21H, 41H, 61H, 81H)

(1) Sets the mode to be entered at a PID operation stop.
The default value (initial value) is set to "monitor".

(2) Operation varies with the mode setting made as indicated below.

Setting mode	Set value	Operation		
		PID operation	Temperature judgment	Alert judgment
Stop	0	×	×	×
Monitor	1	×	○	×
Alert	2	×	○	○

○: Executed
×: Not executed

Operation is governed by the unused channel setting, setting/operation mode setting, PID continuation flag, forced stop command and CPU error stop-time control output setting. (Refer to Section 3.2.13.)

(a) Temperature judgment: A temperature is input from the temperature sensor to check whether it is within the temperature measurement range of the input range setting.
(b) Alert judgment: Alert checks 1 to 4 in Section 3.5.4 are made.

POINT

The default value (initial value) of the stop mode is set to "monitor".
Hence, the channel without a temperature sensor connected results in a sensor input disconnection and the "ALM" LED is lit.
For the channel to which a temperature sensor is not connected, set "1 (unused)" to the unused channel setting buffer memory (3DH, 5DH, 7DH, 9DH).

3.5.14 Set value (SV) setting (buffer memory address: 22H, 42H, 62H, 82H)

(1) Sets the temperature for the set value of PID operation.

(2) The setting range is within the temperature setting range specified in the input range setting (refer to Section 3.5.12).

(3) Setting a value outside the setting range will result in a write error, turn on the write error flag (Xn2), and store the error code (4) to address 0 of the buffer memory.

3.5.15 PID constant setting (buffer memory address: 23H to 25H, 43H to 45H, 63H to 65H, 83H to 85H)

(1) Sets the proportional band (P), integral time (I) and derivative time (D) for performing PID operation.

(2) As the proportional band (P), integral time (I) and derivative time (D), set values within the following ranges.

Item	Addresses (Hexadecimal)				Setting range	Constant for PID operation
	CH.1	CH.2	CH.3	CH.4		
Proportional band (P) setting	23H	43H	63H	83H	0 to 10000	0.0 to 1000.0%
Integral time (I) setting	24H	44H	64H	84H	1 to 3600	1 to 3600 s
Derivative time (D) setting	25H	45H	65H	85H	0 to 3600	0 to 3600 s

(a) Set the proportional band (P) as a percentage (%) to the full scale of the set input range. For example, when the Q64TCRT is used, the input range setting 7 (-200.0 to 600.0°C) is selected, and the proportional band is 10.0%, the proportional band is set to 80.0°C.

(b) For two-position control, set the proportional band to "0".

(c) For PI control, set the derivative time to "0".

(3) When executing auto tuning, do not set "0" to the proportional band.
If its setting is "0", auto tuning will not be executed.

REMARK

Two-position control is a control method in which ON and OFF alternate with each other at two manipulated values of 0% and 100% with respect to the set value to keep the temperature constant.

3.5.16 Alert alarm 1 to 4 setting (buffer memory address: 26H to 29H, 46H to 49H, 66H to 69H, 86H to 89H)

(1) Sets the temperature at which the alert alarm 1 to 4 mode setting (buffer memory address: C0H to C3H, D0H to D3H, E0H to E3H, F0H to F3H) will turn on.

(2) The setting range is within the temperature setting range specified in the input range setting (refer to Section 3.5.12).

(3) Setting a value outside the setting range or setting a value other than 0 to the setting range in mode setting 0 will result in a write error, turn on the write error flag (Xn2), and store the error code (4) to address 0 of the buffer memory.

3.5.17 Upper/lower output limiter setting (buffer memory address: 2AH, 2BH, 4AH, 4BH, 6AH, 6BH, 8AH, 8BH)

(1) Sets the upper and lower limit values for actually outputting the manipulated value (MV) calculated by PID operation to an external device.

(2) The setting range is -50 to 1050 (-5.0% to 105.0%).
Make setting so that the (lower output limiter value) is less than the (upper output limiter value).

3.5.18 Output variation limiter setting (buffer memory address: 2CH, 4CH, 6CH, 8CH)

(1) This function suppresses the variation of the manipulated value updated every second.

(2) The setting range is 1 to 1000 (0.1 to 100.0%).
For example, when the output variation limiter is set to 10 (1.0%), the output variation will be 1% per second at a sudden manipulated value change of 50%, and it will take 50 seconds until the output value changes to 50% actually.

(3) Setting 0 disables the output variation limiter function.

(4) When two-position control is exercised, the output variation limiter function setting is ignored.

3.5.19 Sensor compensation value setting (buffer memory address: 2DH, 4DH, 6DH, 8DH)

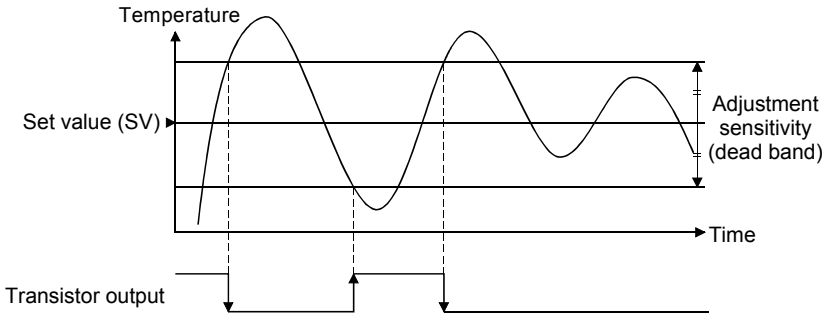
(1) Sets the compensation value used when there is a difference between the measure temperature and the actual temperature due to measured temperature conditions, etc. (Refer to Section 3.2.4.)

(2) Set the value within the range -5000 to 5000 (-50.00% to 50.00%) relative to the full scale of the preset input range.

3.5.20 Adjustment sensitivity (dead band) setting (buffer memory address: 2EH, 4EH, 6EH, 8EH)

(1) Sets the adjustment sensitivity for the set value to prevent chattering of the transistor output.

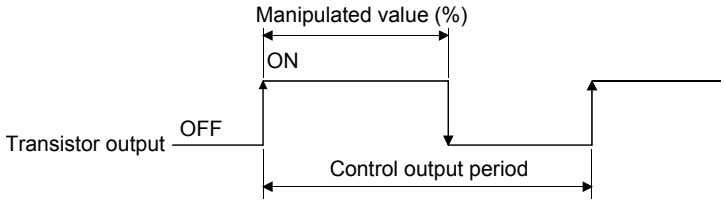
(2) Set the sensitivity within the range 1 to 100 (0.1% to 10.0%) relative to the full scale of the preset input range.



$$\frac{(\text{Full scale}) \times (\text{adjustment sensitivity})}{1000} = \frac{(400-(-200)) \times 10}{1000} = 6.0\ ^\circ\text{C}$$

3.5.21 Control output period setting (buffer memory address: 2FH, 4FH, 6FH, 8FH)

(1) Sets the pulse cycle (ON/OFF cycle) of the transistor output.

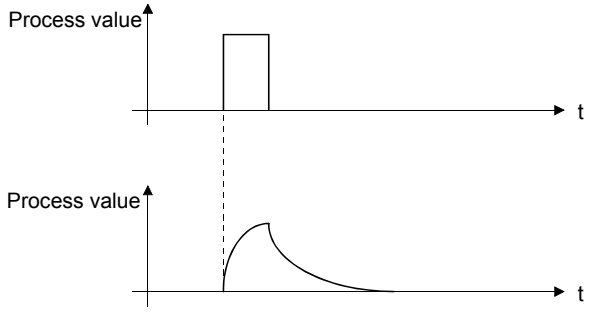


(2) The setting range is 1 to 100 (1 to 100s).

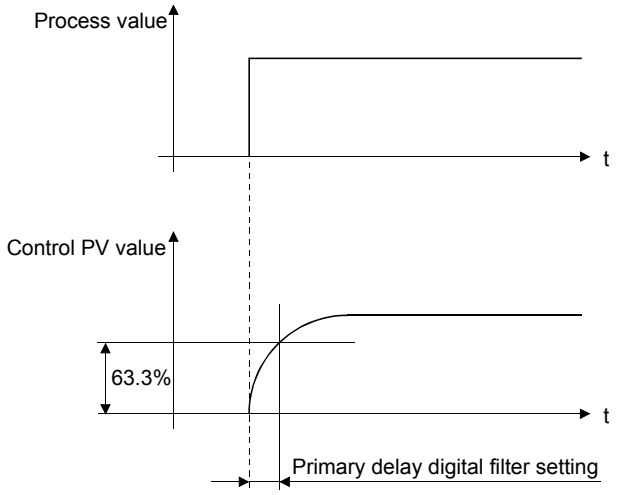
(3) The ON time of the control output period is found by multiplying the control output period by the manipulated value (%) calculated by PID operation. (Refer to Section 3.5.6.)

3.5.22 Primary delay digital filter setting (buffer memory address: 30H, 50H, 70H, 90H)

(1) The primary delay digital filter is designed to absorb sudden changes when the process value (PV) is input in a pulse format.



(2) As the primary delay digital filter setting (filter setting time), specify the time for the PV value to change 63.3%.



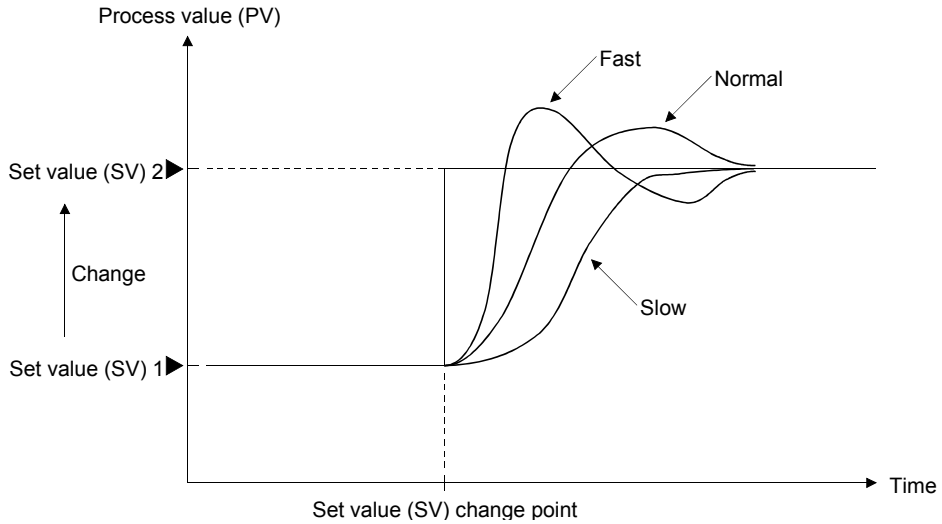
3.5.23 Control response parameter setting (buffer memory address: 31H, 51H, 71H, 91H)

(1) The control response parameter is used to set the response to a PID control set value (SV) change in any of three levels (fast, normal and slow).

(a) Fast : Choose this level to give faster response to a set value change. Note that the setting of "Fast" will increase overshooting.

(b) Slow : Choose this level to suppress the overshooting of a set value change. Note that this will increase the settling time.

(c) Normal: Provides the intermediate characteristic between "Fast" and "Slow".



3.5.24 AUTO/MAN setting (buffer memory address: 32H, 52H, 72H, 92H)

(1) This setting is made to select the manipulated value between the PID operation-calculated value and the user-set value.

- AUTO : The manipulated value calculated by PID operation is used to calculate the ON time of the control period.
- MAN : The manipulated value written to the manual output setting buffer memory (33H, 53H, 73H, 93H) is used to calculate the ON time of the control period.

(2) When AUTO is switched to MAN, the PID operation-calculated value is transferred to the manual output setting buffer memory to prevent a sudden manipulated value change. (Bumpless switching)
On completion of switching to the manual mode, the corresponding bit of the manual mode shift completion flag (buffer memory address: 1EH) turns to 1 (ON).
Set the manipulated value in the MAN mode after making sure that the corresponding bit of the manual mode shift completion flag has turned on.

(3) When executing auto tuning, set "0: Auto (AUTO)".
When the setting is "1: Manual (MAN)", auto tuning will not be executed.

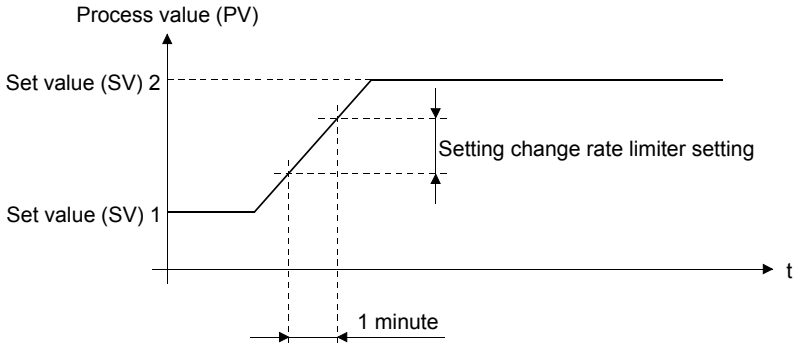
3.5.25 MAN output setting (buffer memory address: 33H, 53H, 73H, 93H)

(1) This area is used to set the manipulated value in the "MAN" mode.

(2) Write a value to the MAN output setting buffer memory after confirming that the corresponding bit of the manual mode shift completion flag (buffer memory address: 1EH) has turned to 1 (ON).
If this setting is made when the manual mode shift completion flag is off, the system will rewrite it to the manipulated value calculated by PID operation.

3.5.26 Setting change rate limiter setting (buffer memory address: 34H, 54H, 74H, 94H)

(1) This setting is made to set the variation of the set value per minute to a set value (SV) change. This will suppress a derivative kick (sudden change in the manipulated value).

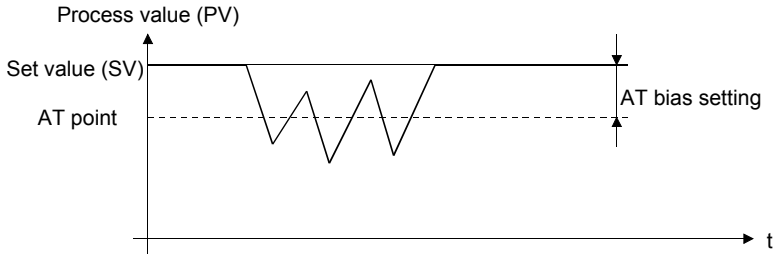


(2) Make this setting as a percentage of the input range setting (buffer memory address: 20H, 40H, 60H, 80H) to the full scale.
The setting range is 0 to 1000 (0 to 100.0%/min).
When 0 is set, the change rate limit setting is invalid.

3.5.27 AT bias setting (buffer memory address: 35H, 55H, 75H, 95H)

(1) This setting is made to perform auto tuning centering on a shifted point (AT point). Make this setting when shifting the point of the set value (SV) for auto tuning. Make this setting if an excess of the process value over the set value (SV) will be inconvenient for auto tuning.

(2) Set the range which has minimal PID operation fluctuations and will not affect the control results.
Otherwise, exact PID constants may not be provided depending on the object to be controlled.
[Setting of AT bias on negative side (for reverse action)]



(3) The setting range is ±input range.

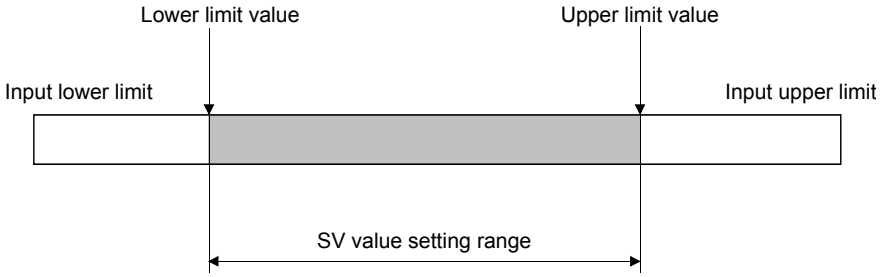
3.5.28 Forward/reverse action setting (buffer memory address: 36H, 56H, 76H, 96H)

(1) Sets whether each channel of the Q64TC will be used for forward or reverse action.
- Forward action (cooling control): 0
- Reverse action (heating control): 1

3.5.29 Upper/lower setting limiter (buffer memory address: 37H, 38H, 57H, 58H, 77H, 78H, 97H, 98H)

(1) Sets the upper and lower limits of the set value (SV).

(2) Set a value within the temperature measurement range specified for the input range.
Make setting so that the (lower output limiter value) is less than the (upper output limiter value).



3.5.30 Heater disconnection alert setting (buffer memory address: 3AH, 5AH, 7AH, 9AH)

(1) Sets the value set for heater disconnection detection or output off-time current error detection as a percentage (%) of the reference heater current value.

(2) The setting range is 0 to 100%.
When the value is 0, heater disconnection detection and output off-time current error detection are not performed.

3.5.31 Loop disconnection detection judgment time setting (buffer memory address: 3BH, 5BH, 7BH, 9BH)

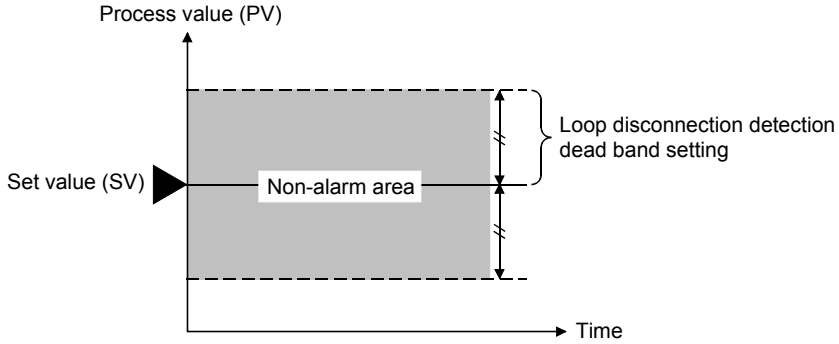
(1) The loop disconnection detection function detects errors in the control system due to a load disconnection, external operation device fault, sensor disconnection and the like.
No temperature change of greater than 2°C (2°F) within the loop disconnection detection judgment time is judged as a loop disconnection.

(2) As the loop disconnection detection judgment time, set a value longer than the time taken to vary the temperature 2°C (2°F).

(3) Performing auto tuning automatically sets a value twice longer than the integral time as the loop disconnection detection judgment time.
However, if the loop disconnection detection judgment time was set to 0 at the auto tuning, the loop disconnection detection judgment time is not stored.

3.5.32 Loop disconnection detection dead band setting (buffer memory address: 3CH, 5CH, 7CH, 9CH)

(1) To prevent the false alarm of loop disconnection detection, set the non-alarm area (temperature width where loop disconnection will not be detected) around the set value.



(2) The setting range is within the temperature setting range defined by the input range setting (refer to Section 3.5.12).
For example, if the loop disconnection detection dead band setting is "50" at the input range setting of 38, loop disconnection detection judgment is not made within the set value ±5.0°C range.

3.5.33 Unused channel setting (buffer memory address: 3DH, 5DH, 7DH, 9DH)

(1) Used to specify as unused the channels where temperature control will not be performed and temperature sensors will not be connected.

(2) For the channels set as unused, the "ALM" LED will not be lit if a temperature sensor is not connected.

(3) Making default setting registration (Yn9: ON) clears the unused channel setting. When there are channels where temperature control is not performed and temperature sensors are not connected, make unused channel setting after completion of default setting registration.

3.5.34 E^2PROM's PID constant read command (buffer memory address: 3EH, 5EH, 7EH, 9EH)

(1) This command reads PID constants from E^2PROM to buffer memory.
Turn on this command to read E^2PROM values to the following buffer memory addresses.

Buffer memory address name	Addresses (Hexadecimal)			
	CH1	CH2	CH3	CH4
Proportional band (P) setting	23H	43H	63H	83H
Integral time (I) setting	24H	44H	64H	84H
Derivative time (D) setting	25H	45H	65H	85H
Loop disconnection detection judgment time	3BH	5BH	7BH	9BH

(2) This function is the most suitable for use when you want to use the initial settings of the utility and the PID constants backed up on E^2PROM together.

(3) When this command is on, do not make a set value change, E^2PROM backup and default setting registration.

3.5.35 Automatic backup setting after auto tuning of PID constants (buffer memory address: 3FH, 5FH, 7FH, 9FH)

(1) With this function, the PID constants set at completion of auto tuning are backed up automatically by E^2PROM.
When 1 is written to this setting and auto tuning then started, data at the following buffer memory addresses are automatically backed up by E^2PROM on completion of auto tuning.

Buffer memory address name	Addresses (Hexadecimal)			
	CH1	CH2	CH3	CH4
Proportional band (P) setting	23H	43H	63H	83H
Integral time (I) setting	24H	44H	64H	84H
Derivative time (D) setting	25H	45H	65H	85H
Loop disconnection detection judgment time	3BH	5BH	7BH	9BH

(2) Do not change this setting during execution of auto tuning.

(3) While auto tuning is being executed with this setting valid, do not make a set value change, E^2PROM backup and default setting registration.

3.5.36 Alert dead band setting (buffer memory address: A4H)

Sets the dead band for alerts.
Set it within the range 0 to 100 (0.0% to 10.0%) to the full scale of the set input range.
Example) When the input range 2 (0 to 1300°C) and alert dead band setting 5 (0.5%) are selected

$$\frac{(\text{Full scale}) \times (\text{Alert dead band})}{1000} = \frac{(1300-0) \times 5}{1000} = 6.5\,℃$$

For details, refer to Section 3.2.11 (2).

3.5.37 Alert delay count setting (buffer memory address: A5H)

(1) Sets the sampling count for judging an alert.
When the number of alert delay times has been set, the system is placed in an alert status if the sampling count remains within the alert range between when the process value (PV) has fallen within the alert range and when the sampling count reaches or exceeds the number of alert delay times.
Refer to Section 3.2.11 for details.

(2) The setting range is 0 to 255.

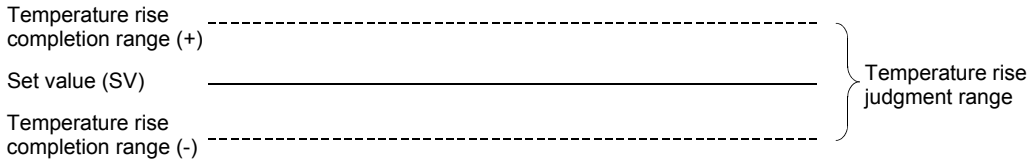
3.5.38 Heater disconnection/output off-time current detection delay count setting (buffer memory address: A6H)

(1) Sets how many heater disconnection detection and output off-time current detection errors will occur consecutively before alert judgment is made.

(2) The setting range is 3 to 255.

3.5.39 Temperature rise completion range setting (buffer memory address: A7H)

(1) Sets the temperature rise/fall values, at which a temperature rise will be judged as completed, relative to the set value.



(2) The setting range is 1 to 10°C.

3.5.40 Temperature rise completion soak time setting (buffer memory address: A8H)

(1) Sets a delay from when a temperature rise is completed until the temperature rise completion judgment flag is turned on (1).

(2) The setting range is 0 to 3600 (min).

3.5.41 PID continuation flag (buffer memory address: A9H)

(1) Sets the operation mode to be entered when the setting mode/operation mode command (Yn1) turns off.
- 0: Stop (default)
- 1: Continue

(2) Refer to Section 3.2.13 for the control status governed by ON/OFF of the PID continuation flag.

3.5.42 Heater disconnection compensation function selection (buffer memory address: AAH)

Sets whether the heater disconnection compensation function (refer to Section 3.2.7) is used or not.
- 0: Heater disconnection compensation function is not used (default)
- 1: Heater disconnection compensation function is used

3.5.43 Transistor ON delay output delay time setting (buffer memory address: AFH)

(1) Make this setting to delay the timing when the transistor output monitor (buffer memory address: b8 of 15H to 18H) turns on.
Set this when performing heater disconnection detection using the input module.

(2) The setting range is 0 and 1 to 50 (10 to 500ms).
When the setting is 0, the transistor output flag (buffer memory address: b8 of 15H to 18H) does not turn on (1).

3.5.44 CT monitor method switching (buffer memory address: B0H)

(1) Sets the method of making heater current measurement.
Choosing the ON current/OFF current measures the present current value of the CT.
Choosing the ON current holds (retains) the previous heater ON-time current value when the heater is OFF.
• 0: ON current/OFF current (default)
• 1: ON current

3.5.45 Manipulated value (MV value, 0 to 4000/0 to 12000/0 to 16000, buffer memory address: B1H to B4H)

(1) Stores the value of the manipulated value at the buffer memory address (DH to 10H) to be output to the digital-to-analog converter module.

(2) The value stored is in the range 0 to 16000.

(3) When the equipment to be heated or cooled is analog input equipment, output the manipulated value to the digital-to-analog converter module to convert it into an analog value.

3.5.46 Manipulated value resolution switching (buffer memory address: B5H)

(1) Choose any of the following three different resolutions for the manipulated value (buffer memory address: B1H to B4 H).
• 0: 0 to 4000 (default)
• 1: 0 to 12000
• 2: 0 to 16000

3.5.47 Auto tuning mode selection (buffer memory address: B8H to BBH)

According to the controlled object to be used, choose the auto tuning mode from the "standard mode" and "fast response mode".
The standard mode is compatible with almost all controlled objects.

(1) Standard mode

This mode is compatible with almost all controlled objects. This mode is especially effective for controlled objects which give an extremely slow response or which may be affected by noise or interference.
For the controlled object where either the ON or OFF time during auto tuning is about only 10 seconds, slow-response (low-gain) PID constants may be calculated. In this case, fast-response PID constants can be calculated by executing auto tuning in the fast response mode.

(2) Fast response mode

This mode calculates faster-response (higher-gain) PID constants for the controlled object which gives a fast response where the ON or OFF time during auto tuning is about only 10 seconds.
Note that the gains of the calculated PID constants may become so high that the control temperature (PV) may oscillate near the set value (SV). In this case, execute auto tuning in the standard mode.

POINT

(1) If auto tuning mode selection is performed using the utility package, Version 1.10L or a subsequent product version is necessary.

(2) Error code 2 (A value other than 0 was input to the restricted area.) occurs if the high response mode is set for a function version A unit. Set the standard mode.

3.5.48 Alert alarm 1 to 4 mode setting (buffer memory address: C0H to C3H, D0H to D3H, E0H to E3H, F0H to F3H)

(1) Sets the alert mode which gives an alarm.
No alert alarm will be given if "0" is set to the alert alarm 1 to 4 mode setting buffer memory (C0H to C3H, D0H to D3H, E0H to E3H, F0H to F3H).

(2) The alert values of alert alarms 1 to 4 are set to the following buffer memory addresses.
- Channel 1: 26H to 29H
- Channel 2: 46H to 49H
- Channel 3: 66H to 69H
- Channel 4: 86H to 89H

(3) The correspondences between buffer memory addresses and channels are listed below.

Mode setting item	CH1	CH2	CH3	CH4
Alert 1	C0H	D0H	E0H	F0H
Alert 2	C1H	D1H	E1H	F1H
Alert 3	C2H	D2H	E2H	F2H
Alert 4	C3H	D3H	E3H	F3H

(4) The following table indicates the alert modes and set values.
Refer to Section 3.2.11 for the alert alarms of the Q64TC.

Alert mode	Setting	Alert mode	Setting	Alert mode	Setting
Upper limit input alert	1	Upper limit input alert with wait	7	—	—
Lower limit input alert	2	Lower limit input alert with wait	8	—	—
Upper limit deviation alert	3	Upper limit deviation alert with wait	9	Upper limit deviation alert with re-wait	12
Lower limit deviation alert	4	Lower limit deviation alert with wait	10	Lower limit deviation alert with re-wait	13
Upper/lower limit deviation alert	5	Upper/lower limit deviation alert with wait	11	Upper/lower limit deviation alert with re-wait	14
Within-range alert	6	—	—	—	—

3.5.49 Heater current measurement value (buffer memory address: 100H to 107H)

(1) Stores the heater current detected by the Q64TC.

(2) Stores the value within the range set for CT selection (buffer memory address: 110H to 117 H).
Held at the upper limit value if the heater current value exceeds the upper limit value of the measurement range.

POINT

Either of the following values must be set to start heater current measurement.
- CT input channel assignment setting (buffer memory address: 108H to 10FH)
- Reference heater current value (buffer memory address: 118H to 11FH)

When both are 0, heater current measurement is not made.

3.5.50 CT input channel assignment setting (buffer memory address: 108H to 10FH)

(1) Sets how the CT inputs will be assigned to the channels.

(2) The following table lists the CT inputs and set values.

CT input	Buffer memory address	Set value
CT1	108H	Assignment is made by writing any of the following values to each address indicated on the left. 0: Unused (default) 1: Channel 1 2: Channel 2 3: Channel 3 4: Channel 4
CT2	109H	
CT3	10AH	
CT4	10BH	
CT5	10CH	
CT6	10DH	
CT7	10EH	
CT8	10FH	

(3) When a three-phase heater is used, the same channel is assigned to two CT inputs. Refer to Section 4.4.3 for the setting example.

3.5.51 CT selection (buffer memory address: 110H to 117H)

(1) Chooses the current sensor connected to the Q64TCTTBW or Q64TCRTBW.
- 0: When CTL-12-S36-8 is used (0 to 100.0A) (default)
- 1: When CTL-6-P(-H) is used (0 to 20.00A)

(2) To determine a change in the set value, the setting change command (YnB) must be turned on.

POINT

Refer to Section 2.1 for the current sensors that can be used with the Q64TCTTBW and Q64TCRTBW.
We cannot guarantee operation if any other current sensor (CT) is used.

3.5.52 Reference heater current value (buffer memory address: 118H to 11FH)

(1) Sets the heater ON-time heater current measurement value (buffer memory address: 100H to 107H).

(2) The setting ranges are indicated below.
- When CTL-12-S36-8 is used : 0 to 1000 (0 to 100.0A)
- When CTL-6-P(-H) is used : 0 to 2000 (0 to 20.00A)

4 SETUP AND PROCEDURE BEFORE STARTING THE OPERATION

The following describes the procedure prior to the Q64TC operation, the name and setting of each part of the Q64TC, and wiring method.

4.1 Handling Precautions

The following are the precautions for handling the Q64TC.

(1) Do not drop the module casing or connector, or do not subject it to strong impact.

(2) Do not remove the PCB of each module from its case. Doing so may cause breakdowns.

(3) Be careful not to let foreign particles such or wire chips get inside the module. These may cause fire, breakdowns and malfunctions.

(4) The top surface of the module is covered with a protective film to prevent foreign objects such as wire chips from entering the module when wiring. Do not remove this film until the wiring is complete.
Before operating the system, be sure to remove the film to provide adequate heat ventilation.

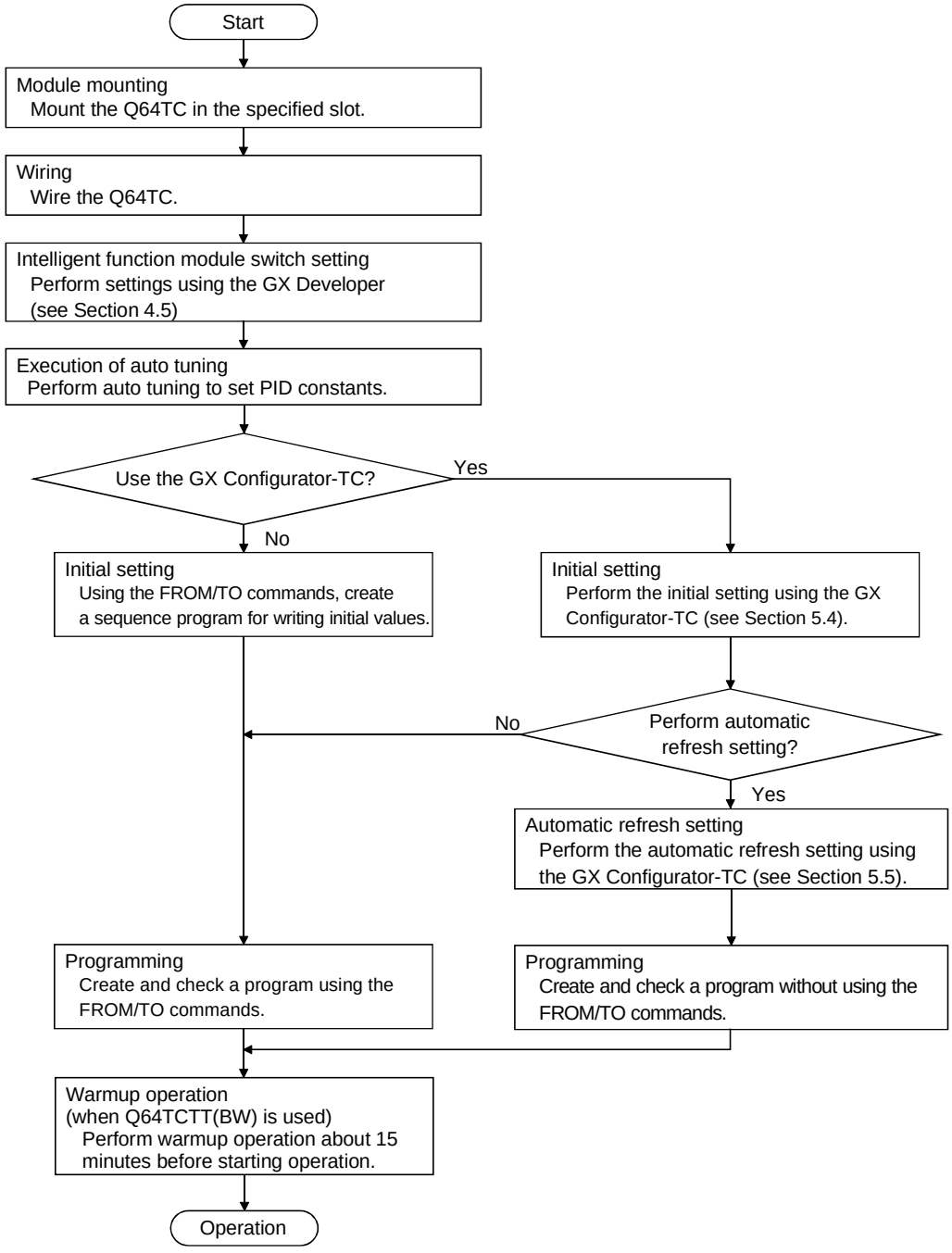
(5) Tighten the mounting and terminal screws of the module to the following specified torques.
Undertightening can cause a short circuit, failure or malfunction.

Screw location	Tightening torque range
Module mounting screw (M3 screw)	0.36 to 0.48N·m
Terminal block terminal screw (M3 screw)	0.42 to 0.58N·m
Terminal block mounting screw (M3.5 screw)	0.66 to 0.89N·m

(6) To mount the module on the base unit, fully insert the module fixing latch into the fixing hole in the base unit and press the module using the hole as a fulcrum. Improper installation may result in a malfunction or breakdown of the module, or may cause the module to fall off.

4.2 Procedure Before Starting the Operation

The figure below shows the steps that should be followed before starting the Q64TC operation.

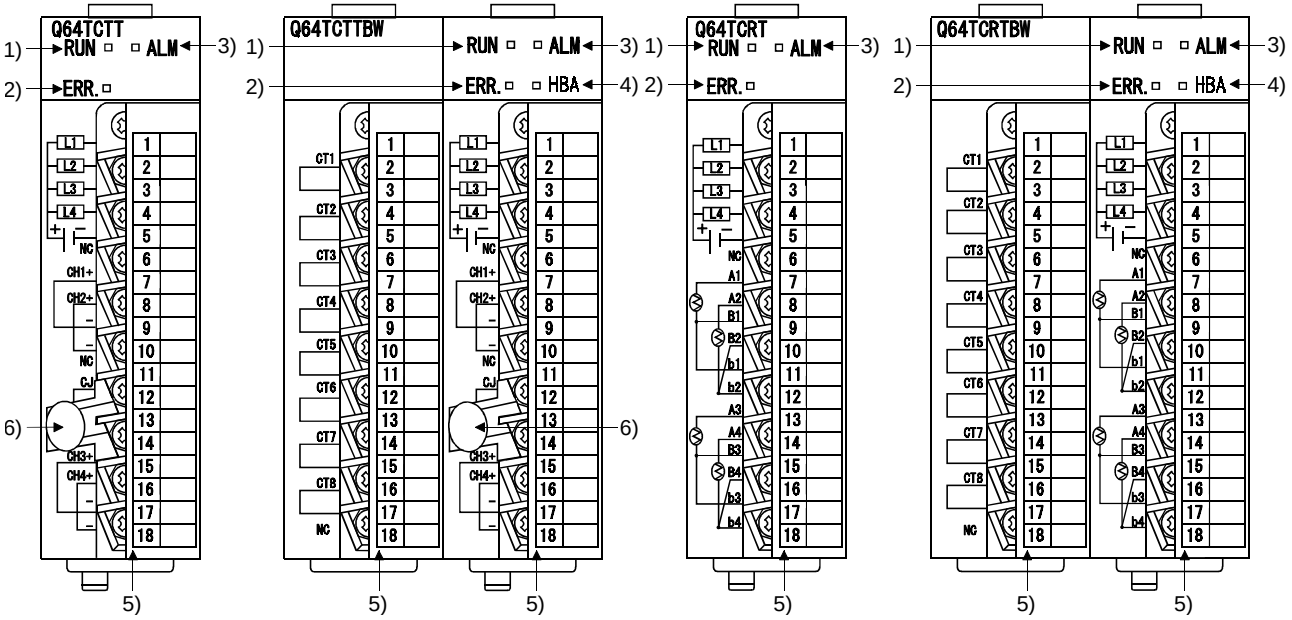


POINT

When using the Q64TCTT(BW) which uses a thermocouple as a temperature sensor, perform warmup operation about 15 minutes before starting operation to make temperature compensation properly.

4.3 Parts Identification

This section explains the names of the Q64TC parts.



Number	Name	Description
1)	RUN LED	Indicates the operating status of the Q64TCTT(BW). On: Operating normally. Off: 5V power is off, watchdog timer error occurred, or CPU stop error occurred with intelligent function module switches of all channels set to "CLEAR".
2)	ERR. LED	Indicates the error status of the Q64TCTT(BW). On : Hardware fault (Including no connection of a cold junction temperature compensation resistor) Flicker : Write data error occurring Off : Operating normally.
3)	ALM LED	Indicates the alert status of the Q64TCTT(BW). On : Alert occurring Flicker : Process value (PV) came out of measured temperature range. Loop disconnection was detected. Sensor is not connected. Off : Alert not occurring
4)	HBA LED	Indicates the heater disconnection detection status of the Q64TCTT(BW). On: Heater disconnection was detected. Off: Heater disconnection is not detected.
5)	Terminal block*	Used for temperature sensor input, transistor output and current sensor (CT) input.
6)	Cold junction temperature compensation resistor	Used when cold junction temperature compensation is made.

*: The terminal block layout varies with the module used.
Respective terminal block layouts are indicated on the following pages.

(1) When using Q64TCTT

Terminal number	Signal name
1	L1
2	L2
3	L3
4	L4
5	COM-
6	Unused
7	CH1+
8	CH2+
9	CH1-
10	CH2-
11	Unused
12	CJ
13	Unused
14	CJ
15	CH3+
16	CH4+
17	CH3-
18	CH4-

(2) When using Q64TCTTBW

Terminal number	Signal name	
1	Unused	L1
2	CT1+	L2
3	CT1-	L3
4	CT2+	L4
5	CT2-	COM-
6	CT3+	Unused
7	CT3-	CH1+
8	CT4+	CH2+
9	CT4-	CH1-
10	CT5+	CH2-
11	CT5-	Unused
12	CT6+	CJ
13	CT6-	Unused
14	CT7+	CJ
15	CT7-	CH3+
16	CT8+	CH4+
17	CT8-	CH3-
18	Unused	CH4-

(3) When using Q64TCRT

Terminal number	Signal name
1	L1
2	L2
3	L3
4	L4
5	COM-
6	Unused
7	A1
8	A2
9	B1
10	B2
11	b1
12	b2
13	A3
14	A4
15	B3
16	B4
17	b3
18	b4

(4) When using Q64TCRTBW

Terminal number	Signal name	
1	Unused	L1
2	CT1+	L2
3	CT1-	L3
4	CT2+	L4
5	CT2-	COM-
6	CT3+	Unused
7	CT3-	A1
8	CT4+	A2
9	CT4-	B1
10	CT5+	B2
11	CT5-	b1
12	CT6+	b2
13	CT6-	A3
14	CT7+	A4
15	CT7-	B3
16	CT8+	B4
17	CT8-	b3
18	Unused	b4

4.4 Wiring

This section provides wiring instructions and module connection examples.

4.4.1 Wiring precautions

External wiring must be noise-resistant as one of the conditions to fully exhibit the Q64TC functions and configure a highly reliably system.
The instructions given below should be followed in wiring.

(1) Use separate cables with the AC control circuit and Q64TC's external input signals to avoid the influence of AC side surges and induction.

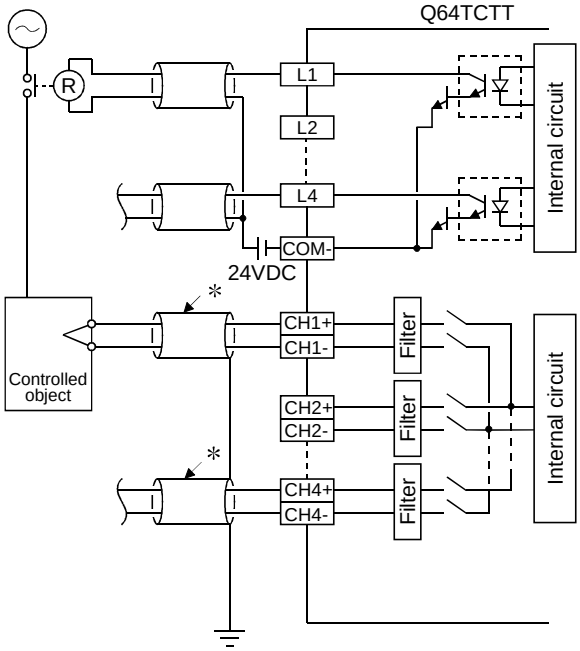
(2) Do not run the cables close to, or bundle them with, the main circuit and high-voltage cables and the load cables from other than the PLC.
Always keep temperature sensors at least 100mm(3.94inch) away from the main circuit cables and AC control circuit.
Fully keep them away from high-voltage cables and circuits which include high frequencies, e.g. inverter load's main circuit.
Failure to do so will make the cables susceptible to noise, surges and induction.

(3) Ground the shield wires or shield cables to FG of the PLC. Note that it may be better to establish a ground on the external side depending on the external noise conditions.

(4) When you want the equipment to conform with the EMC Directive/Low Voltage Directive, refer to "Conformance with the EMC Directive and Low Voltage Directive" in this manual and carry out wiring.

4.4.2 External wiring

(1) For use of Q64TCTT



∗: Always use shielded cables.

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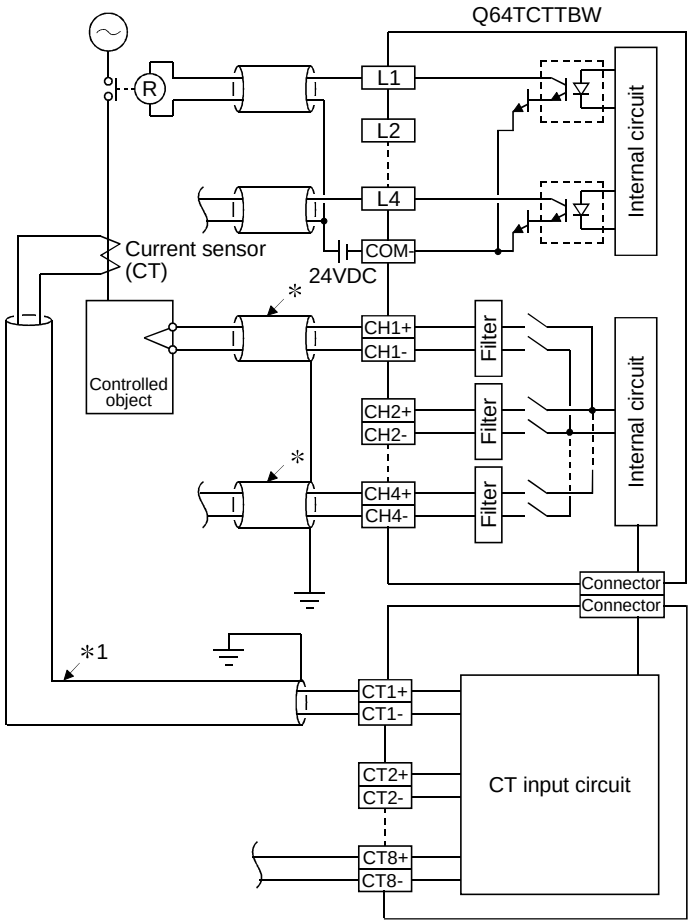
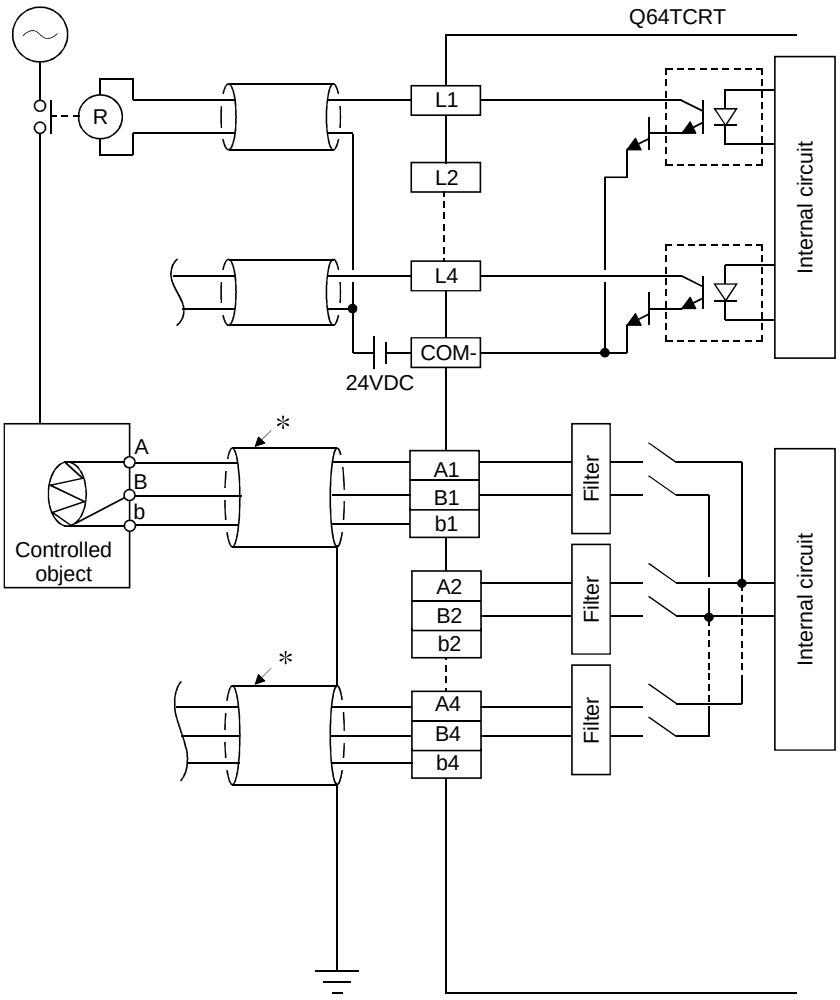
(2) For use of Q64TCTTBW



*: Always use shielded cables.

POINT
To use the heater disconnection detection function, CT input channel assignment setting must be made. Since the above wiring example uses the CT1 in the loop of channel 1, set 1 (channel 1) to the CT1 channel assignment setting buffer memory (108H).

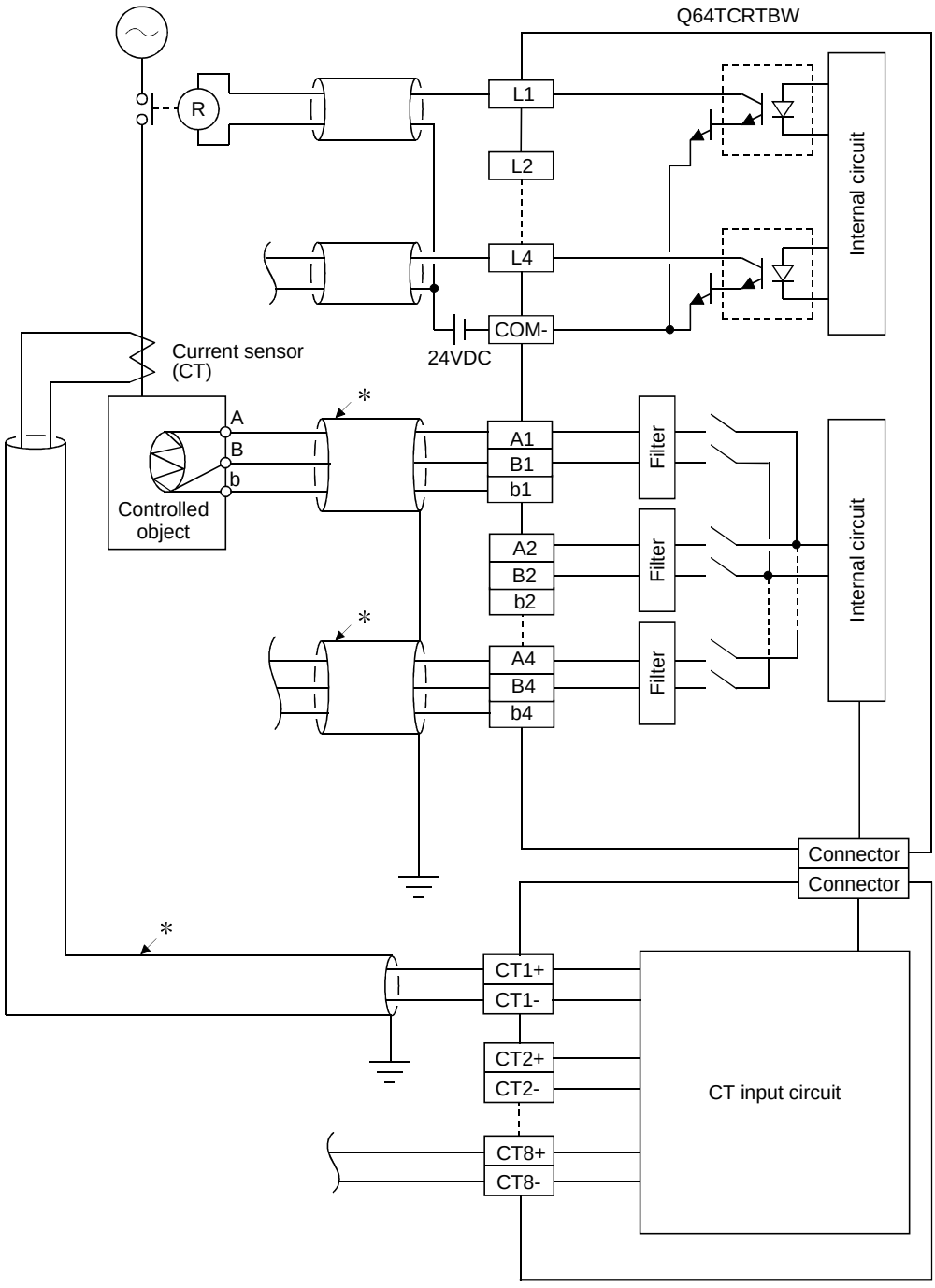
(3) For use of Q64TCRT



*: Always use shielded cables.

4 - 9

(4) For use of Q64TCRTBW

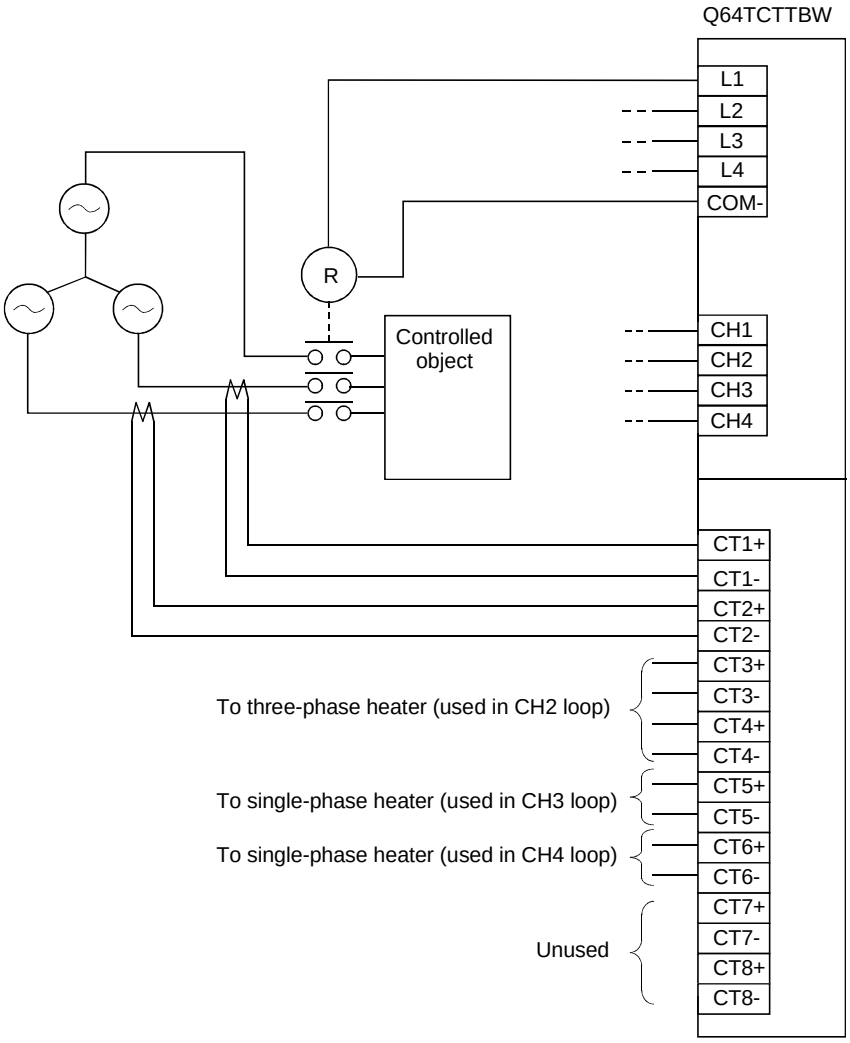


*: Always use shielded cables.

POINT
To use the heater disconnection detection function, CT input channel assignment setting must be made. Since the above wiring example uses the CT1 in the loop of channel 1, set 1 (channel 1) to the CT1 channel assignment setting buffer memory (108H).

4.4.3 Heater disconnection detection wiring and setting example for use of three-phase heater

The following wiring and setting example given below is designed to detect a three-phase heater disconnection using the heater disconnection detection function.



Three-phase hater disconnection detection is made by measuring the currents of two of the three conductors.
In the above wiring example, make CT input channel assignment setting (buffer memory: 108H to 10FH) as indicated below.

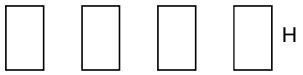
CT input	Buffer memory address	Set value
CT1	108H	1
CT2	109H	1
CT3	10AH	2
CT4	10BH	2
CT5	10CH	3
CT6	10DH	4
CT7	10EH	0
CT8	10FH	0

4.5 Switch Settings for the Intelligent Function Module

This section explains the intelligent function module switch settings.
Make intelligent function module switch settings in I/O assignment setting on GX Developer.
Making intelligent function module switch settings allows you to set to the Q64TC the output status to be established when the PLC CPU has comes to an error stop.
Refer to Section 3.2.12 for setting details.

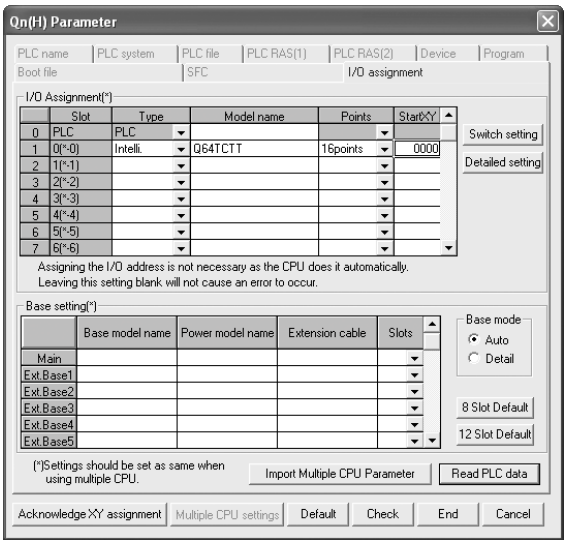
(1) Setting items

Five switches (switch numbers 1 to 5) are available for the intelligent function module and they are set with 16 bit data.
If the switches for the intelligent function module are not set, the default value of 0 is used for switches 1 to 5.

	Setting items	
Switch 1		Output setting for CPU stop error 0 : CLEAR Other than 0 : HOLD
Switch 2	Reserved	
Switch 3	Reserved	
Switch 4	Reserved	
Switch 5	Reserved	

(2) Operating procedure

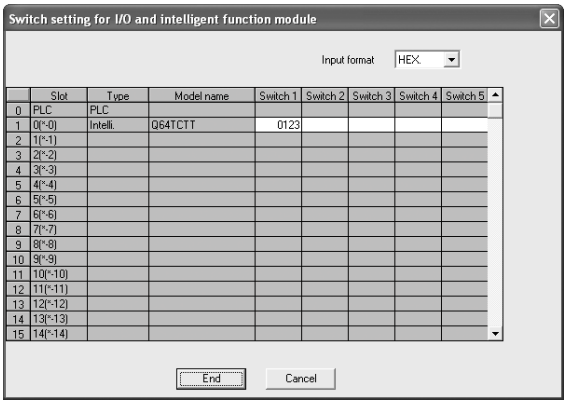
Perform settings, starting with the GX Developer I/O assignment screen.



(a) I/O assignment screen

Specify the following for the slot where theQ64TC is mounted.

Type : Select "Intelli."
Model name : Enter the module's model name.
Points : Select 16 points.
Start XY : Enter the start I/O signal for the Q64TC.



(b) Switch setting for I/O and intelligent function module

Click on Switch Setting on the I/O assignment screen to display the screen at left and set switches 1 to 5. The setting can easily be done if values are entered in hexadecimal. Change the input format to hexadecimal and enter values.

REMARK

You need not set the "error-time output mode" and "hardware error-time CPU operation mode" in the intelligent function module detailed setting as they are invalid for the Q64TC.

5 UTILITY PACKAGE (GX Configurator-TC)

5.1 Utility Package Functions

Table 5.1 shows a list of the utility package functions.

Table 5.1 Utility Package (GX Configurator-TC) Function List

Function	Description	Reference section
Initial setting	(1) Make initial setting for operating the temperature control module channel-by-channel. Set the values of the items which require initial setting. •CH□ Input Range •CH□ Target Value Setting(SV) •CH□ Proportion(P) Setting •CH□ Integral Time(I) Setting •CH□ Differential Time(D) Setting •CH□ Output Control Cycle Setting •CH□ Control Response Parameter •CH□ Stop Mode Setting •PID Continue Flag •CH□ Warning1 Mode Setting •CH□ Warning Setting Value1 •CH□ Warning 2 Mode Setting •CH□ Warning Setting Value2 •CH□ Warning 3 Mode Setting •CH□ Warning Setting Value3 •CH□ Warning 4 Mode Setting •CH□ Warning Setting Value4 •Warning Non Sensitive Zone Setting •Warning Delay Count •CH□ Loop Down Detect Decision Time •CH□ Loop Down Detect Dead Band •CH□ Heater Down Warning Setting •Heater Down/OFF Time Abnormal Current Detect Delay Count •Heater Down Correction Function Select •CT Monitor Format Change •CT□ Channel Layout Setting •CT□ CT Select •CT□ Standard Heater Current Value •CH□ Upper Limit Setting Limiter •CH□ Lower Limit Setting Limiter •CH□ Forward/Reverse Operation Setting •CH□ Change Rate Limiter Setting •CH□ Sensor Correction Value Setting •CH□ Temporary Delay Digital Filter Setting •CH□ Upper Limit Output Limiter •CH□ Lower Limit Output Limiter •CH□ Output Change Level Limiter •CH□ Sensor Adjustment(Dead band)Setting •CH□ AT Bias •CH□ Unused Channel Setting •Transistor ON Time Output Delay Monitor Setting •Operation Level Resolution Change •Temperature Rise Complete Range Setting •Temperature Rise Complete Sock Time Setting (2) The initially set data are registered to the PLC CPU parameters, and when the PLC CPU is set to the RUN mode, they are written to the temperature control module automatically.	Section 5.4
Automatic refresh	(1) Set the automatically refreshed temperature control module buffer memory channel-by-channel. •Data Write Error Code •CH□ Measured Temperature Value(PV) •CH□ Operation Level(MV) •CH□ Target Value Setting(SV) •CH□ Transistor Output Flag •CH□ Occurred Warning Content •CH□ Warning Setting Value1 •CH□ Warning Setting Value2 •CH□ Warning Setting Value3 •CH□ Warning Setting Value4 •CH□ Proportion(P) Setting •CH□ Integral Time(I) Setting •CH□ Differential Time(D) Setting •CH□ Heater Down Warning Setting •CH□ Measured Heater Current Value •CH□ Operation Level •CH□ Temperature Rise Decision Flag (2) The values stored in the temperature control module buffer memory where automatic refresh setting was made are automatically read when the END instruction of the PLC CPU is executed.	Section 5.5

Function	Description	Reference section
Monitor/test	Monitors and tests the buffer memory and I/O signals for the temperature control module. you can use the auto tuning function. •Write Data Error Code •CH□ Decimal Point Place •CH□ Measured Temperature Value(PV) •CH□ Operation Level(MV) •CH□ Target Value Setting(SV) •CH□ Transistor Output Flag •CH□ ON Delay Output •X00:Module Ready Flag •X01:Setting/Operation Mode Status •X02:Write Error Flag •X03:Hardware Error Flag •X04:CH1 Auto Tuning Status •X05:CH2 Auto Tuning Status •X06:CH3 Auto Tuning Status •X07:CH4 Auto Tuning Status •X08:E^2PROM Write Completion Flag •X09: Default Value Write Completion Flag •X0A:E^2PROM Write Fail Flag •X0B:Setting Change Completion Flag •X0C:CH1 Warning Occurred Flag •X0D:CH2 Warning Occurred Flag •X0E:CH3 Warning Occurred Flag •X0F:CH4 Warning Occurred Flag •Y01:Setting/Operation Mode Instruction •Y02:Error Reset Instruction •Y04:CH1 Auto Tuning Instruction •Y05:CH2 Auto Tuning Instruction •Y06:CH3 Auto Tuning Instruction •Y07:CH4 Auto Tuning Instruction •Y08:E^2PROM Backup Instruction •Y09:Default Setting Registry Instruction •Y0B:Setting Change Instruction •Y0C:CH1 PID Calculation Compulsory •Y0D:CH2 PID Calculation Compulsory •Y0E:CH3 PID Calculation Compulsory •Y0F:CH4 PID Calculation Compulsory •CH□ Proportion(P) Setting •CH□ Integral Time(I) Setting •CH□ Differential Time(D) Setting •CH□ E^2PROM PID Constant Read Instruction •CH□ E^2PROM PID Constant Read Completion Flag •CH□ Output Control Cycle Setting •CH□ Control Response Parameter •CH□ Stop Mode Setting •PID Continue Flag •CH□ Stop Mode Setting •PID Continue Flag •CH□ Temperature Value (PV) Upper Limit Cross Warning •CH□ Temperature Value (PV) Lower Limit Cross Warning •CH□ Warning1 •CH□ Warning2 •CH□ Warning3 •CH□ Warning4 •CH□ Heater Down Warning •CH□ Loop Down Warning •CH□ OFF Time Abnormal Current Warning •CH□ Warning1 Mode Setting •CH□ Warning Setting Value1 •CH□ Warning2 Mode Setting •CH□ Warning Setting Value2 •CH□ Warning3 Mode Setting •CH□ Warning Setting Value3 •CH□ Warning4 Mode Setting •CH□ Warning Setting Value4 •Warning Non Sensitive Zone Setting •Warning Delay Count •CH□ Loop Down Detect Decision Time •CH□ Loop Down Detect Dead Band •CH□ Heater Down Warning •Heater Down/OFF Time Abnormal Current Detect Delay Count •Heater Down Correction Function Select •CT Monitor Format Change •CT□ Measured Heater Current Value •CT□ Channel Layout Setting •CT□ CT Select •CT□ Standard Heater Current Value •CH□ Operation Level •Operation Level Resolution Change •CH□ Temperature Rise Decision Flag •Temperature Rise Complete Range Setting •Temperature Rise Complete Sock Time Setting •CH□ Input Range •CH□ Upper Limit Setting Limiter •CH□ Lower Limit Setting Limiter •CH□ Forward/Reverse Operation Setting •CH□ Change Rate Limiter Setting •CH□ Sensor Correction Value Setting •CH□ Temporary Delay Digital Filter Setting •CH□ Upper Limit Output Limiter •CH□ Lower Limit Output Limiter •CH□ Output Change Level Limiter •CH□ Sensor Adjustment(Dead band) •CH□ AT Bias •CH□ Unused Channel Setting •Transistor ON Time Output Delay Monitor Setting •CH□ MAN Mode Switch Completion Flag •CH□ AUTO/MAN Mode Change •CH□ MAN Output Setting •Auto Tuning	Section 5.6

5.2 Installing and Uninstalling the Utility Package

See "Method of installing the MELSOFT Series" attached with the utility package regarding the install and uninstall operation for the utility package.

5.2.1 User precautions

The following explains the precautions on using the Utility package:

(1) Important safety information

Since the utility is add-in software for GX Developer, make sure to read "Safety Precautions" and the basic operating procedures in the GX Developer Operating Manual.

(2) About installation

GX Configurator-TC is an add-in software package for GX Developer Version 4 or later products. Therefore, install GX Configurator-TC in a personal computer in which GX Developer Version 4 or later product has been installed.

(3) About display screen errors while using the intelligent function module utility

There may be cases in which the screen will not properly display while the intelligent function module utility is being used, due to a lack of system resources. If this occurs, close the intelligent function module utility first, and then close GX Developer (program, comments, etc.) and other applications. Next, restart GX Developer and the intelligent function module utility.

(4) To start the intelligent function module utility

(a) In GX Developer, select "QCPU (Q mode)" for the PLC series and specify the project. If anything other than "QCPU (Q mode)" is selected for the PLC series, or if no project is specified, the intelligent function module utility will not start.

(b) Multiple intelligent function module utilities can be started.
However, the [Open file]/[Save file] parameter operations of the intelligent function module can only be performed by a single intelligent function module utility. Other intelligent function module utilities can perform the [Monitor/test] operation only.

(5) How to switch screens when two or more intelligent function module utilities are started

When two or more intelligent function module utility screens cannot be displayed side by side, use the task bar to display the desired intelligent function module utility screen on top of other screens.

(6) About the number of parameters that can be set in GX Configurator-TC

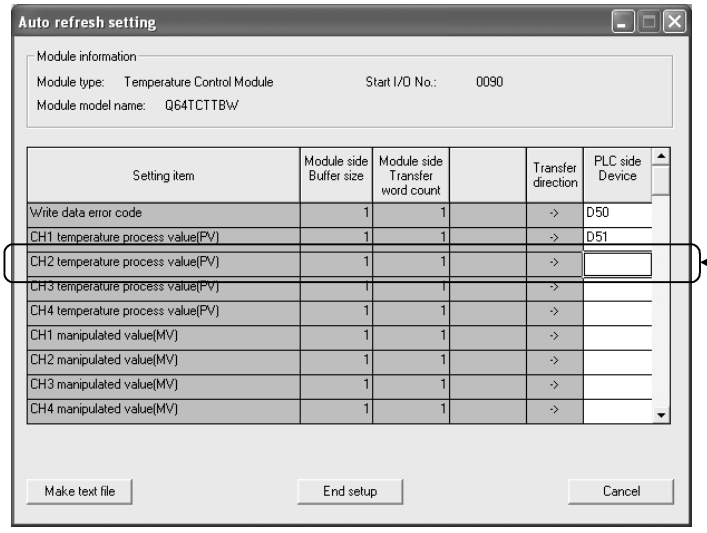
The number of parameters that can be set by the GX Configurator for an intelligent function module installed in the CPU module and in a remote I/O station of the MELSECNET/H network system is limited.

Intelligent function module installation object	Maximum number of parameter settings	
	Initial setting	Automatic refresh setting
Q00J/Q00/Q01CPU	512	256
Q02/Q02H/Q06H/Q12H/Q25HCPU	512	256
Q12PH/Q25PHCPU	512	256
MELSECNET/H remote I/O station	512	256

For example, if multiple intelligent function modules are installed in a remote I/O station, set the GX Configurator so that the number of parameter settings of all the intelligent function modules does not exceed the maximum number of parameter settings.The total number of parameter settings is calculated separately for the initial setting and for the automatic refresh setting.
The number of parameter settings that can be set for one module in the GX Configurator-TC is as shown below.

Object Module	Initial setting	Automatic refresh setting
Q64TCTT/Q64TCRT	21 (Fixed)	61 (Maximum number of settings)
Q64TCTTBW/Q64TCRTBW	21 (Fixed)	73 (Maximum number of settings)

Example) Counting the number of parameter settings in the automatic refresh setting


Auto refresh setting
Module information
Module type: Temperature Control Module
Start I/O No.: 0090
Module model name: Q64TCTTBW
Setting item
Module side Buffer size
Module side Transfer word count
Transfer direction
PLC side Device
Write data error code 1 1 -> D50
CH1 temperature process value(PV) 1 1 -> D51
CH2 temperature process value(PV) 1 1 ->
CH3 temperature process value(PV) 1 1 ->
CH4 temperature process value(PV) 1 1 ->
CH1 manipulated value(MV) 1 1 ->
CH2 manipulated value(MV) 1 1 ->
CH3 manipulated value(MV) 1 1 ->
CH4 manipulated value(MV) 1 1 ->
Make text file
End setup
Cancel

The number of settings in this one line is counted as one setting.
The number of settings is not counted by columns.
Add up all the setting items in this setting screen, then add them to the total for the other intelligent function modules to get a grand total.

5.2.2 Operating environment

The operating environment of the personal computer where the GX Configurator-TC is used is explained.

Item		Peripheral devices
Installation (Add-in) destination ＊1		Add-in to GX Developer Version 4 (English version) or later ＊2
Computer main unit		Personal computer on which Windows® operates.
	CPU	Refer to the following table "Used operating system and performance required for personal computer".
	Required memory	
Hard disk free space	For installation	65 MB or more
	For operation	10 MB or more
Display		800 × 600 dot or more resolution
Operating system		Microsoft® Windows® 95 Operating System (English version) Microsoft® Windows® 98 Operating System (English version) Microsoft® Windows® Millennium Edition Operating System (English version) Microsoft® Windows NT® Workstation Operating System Version 4.0 (English version) Microsoft® Windows® 2000 Professional Operating System (English version) Microsoft® Windows® XP Professional Operating System (English version) Microsoft® Windows® XP Home Edition Operating System (English version)

＊1: Install the GX Configurator-TC in GX Developer Version 4 or higher in the same language.
GX Developer (English version) and GX Configurator-TC (Japanese version) cannot be used in combination, and GX Developer (Japanese version) and GX Configurator-TC (English version) cannot be used in configuration.

＊2: GX Configurator-TC cannot be used as an add-in with GX Developer Version 3 or earlier versions.

Used operating system and performance required for personal computer

Operating system	Performance Required for Personal Computer	
	CPU	Required memory
Windows® 95	Pentium® 133MHz or more	32MB or more
Windows® 98	Pentium® 133MHz or more	32MB or more
Windows® Me	Pentium® 150MHz or more	32MB or more
Windows NT® Workstation 4.0	Pentium® 133MHz or more	32MB or more
Windows® 2000 Professional	Pentium® 133MHz or more	64MB or more
Windows® XP Professional (Service Pack1 or more)	Pentium® 300MHz or more	128MB or more
Windows® XP Home Edition (Service Pack1 or more)	Pentium® 300MHz or more	128MB or more

POINT

New functions of Windows® XP
When Microsoft® Windows® XP Professional Operating System or Microsoft® Windows® XP Home Edition Operating System is used, the following new functions cannot be used.
If any of the following new functions is used, this product may not operate normally.
- Start of application in Windows® compatible mode
- Fast user switching
- Remote desktop
- Big fonts (Details setting of Screen properties)

5.3 Explanation of Utility Package Operations

5.3.1 How to perform common utility package operations

(1) Available control keys

Special keys that can be used during operations of the utility package and their applications are shown in the table below.

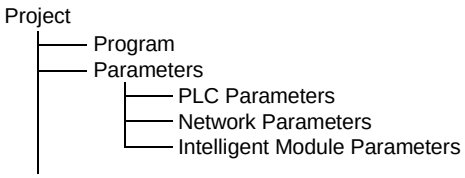
Name of key	Application
Esc	Cancels a newly entered value when entering data in a cell. Closes the window.
Tab	Moves between controls in the window.
Ctrl	Uses together with the mouse when multiple cells are selected in the Test selected.
Delete	Deletes the character where the cursor is positioned. When a cell is selected, clears all of the setting contents.
Back space	Deletes the character where the cursor is positioned.
↑ ↓ ← →	Moves the cursor.
Page Up	Moves the cursor one page up.
Page Down	Moves the cursor one page down.
Enter	Confirms the value entered in the cell.

(2) Data to be created with the utility package

The data and files shown below that are created with the utility package are also used by GX Developer operations. Figure 5.1 shows which operation uses which data or file.

<Intelligent module parameters>

(a) This data is created with the auto refresh setting, and stored in the intelligent module parameter file of the project to be created using GX Developer.



(b) Steps 1) to 3) shown in Figure 5.1 are performed using the following operations.

1) Operating using GX Developer.
[Project] → [Open project] / [Save] / [Save as]
2) Operating on the intelligent module parameter setting module selection screen of the utility.
[File] → [Open file] / [Save file]

3) Operating using GX Developer.
[Online] → [Read from PLC] / [Write to PLC] → "Intelligent module parameter"
Or, operate on the intelligent module parameter setting module selection screen of the utility.
[Online] → [Read from PLC] / [Write to PLC]

<Text file>

(a) A text file can be created by performing the initial setting or auto refresh setting, or selecting [Make text file] on the monitor/test screen. Text files can be utilized to create user documents.

(b) Text files can be saved to any directory.
However, a path (folder where the file is to be saved) cannot be created during [Make text file] operation, so create a folder in advance for saving the file using Windows® Explorer.

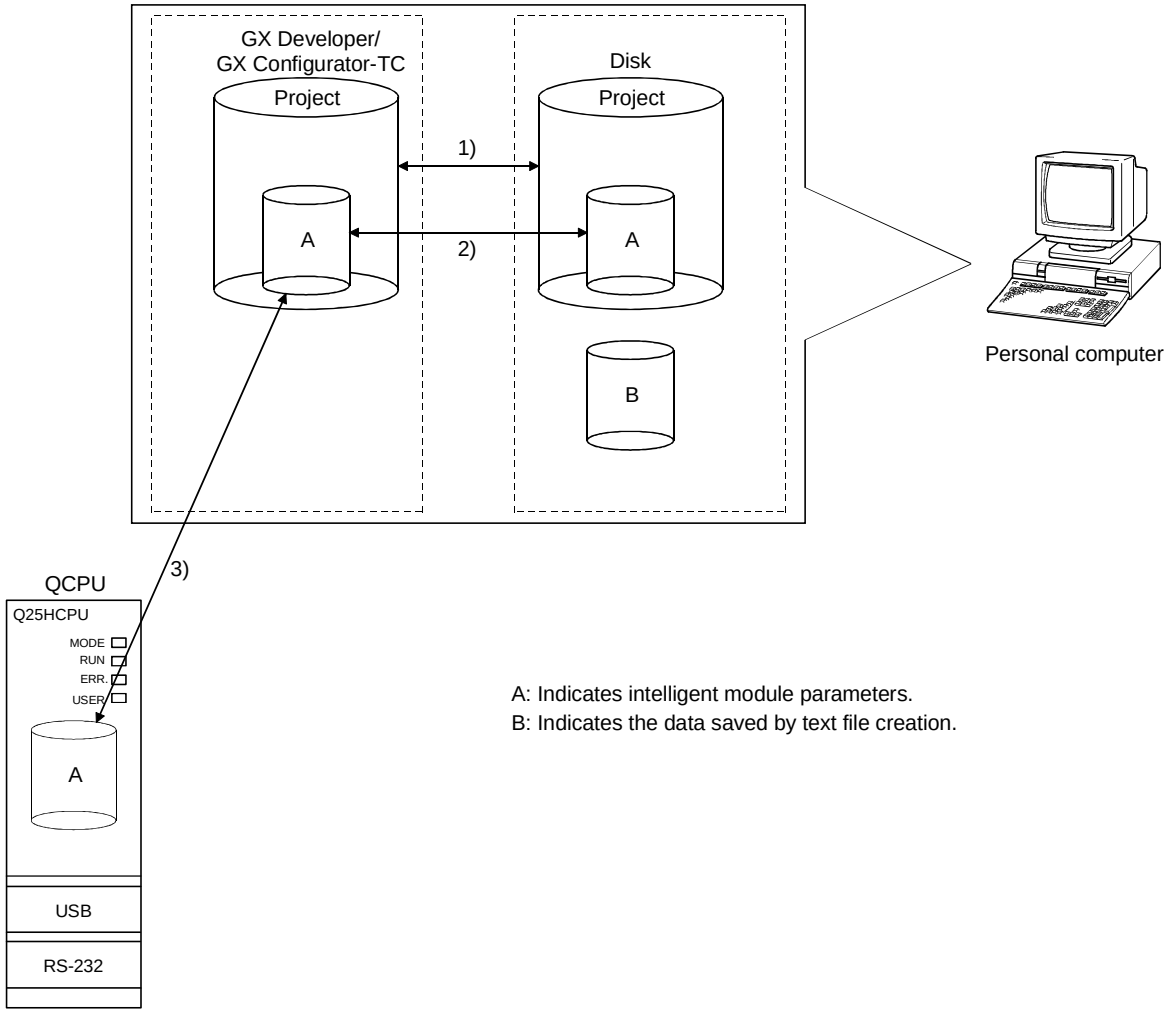
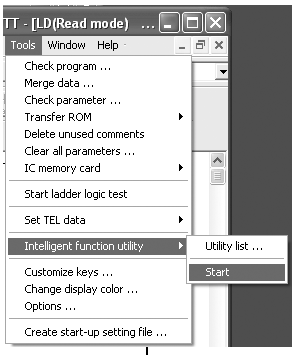


Figure 5.1 correlation diagram for data created using the utility package

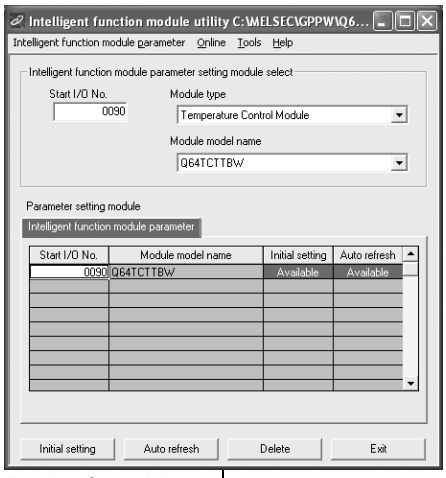
5.3.2 Operation overview

GX Developer screen



[Tools] – [Intelligent function utility] – [Start]

Intelligent module parameter setting module selection screen



See Section 5.3.3

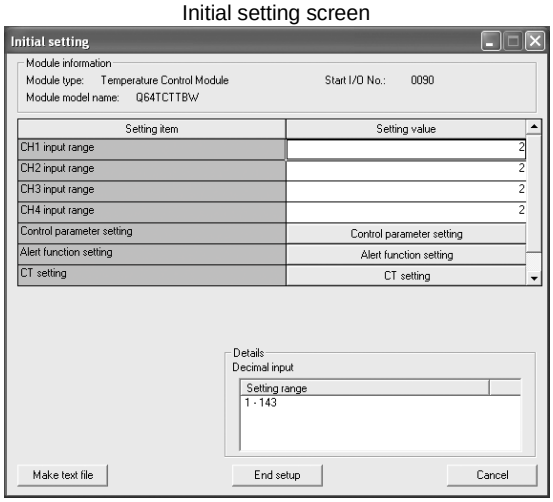
Enter "Start I/O No.", then select "Package name" and "Module model name".

1)

Initial setting

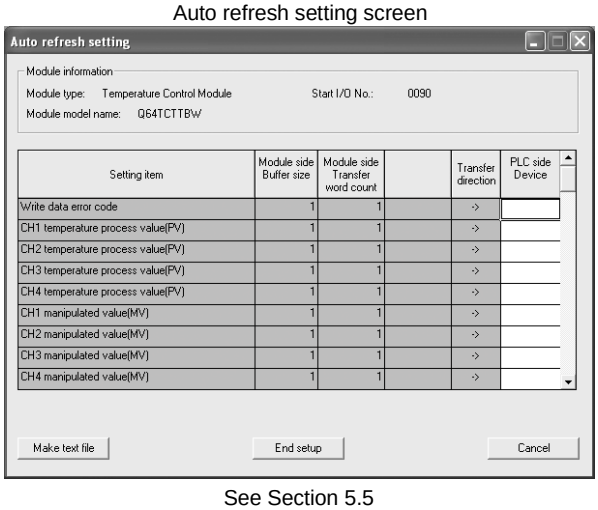
Auto refresh

Initial setting screen



See Section 5.4

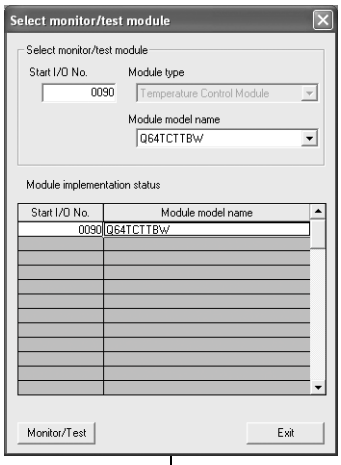
Auto refresh setting screen



See Section 5.5

1) [Online] – [Monitor/test]

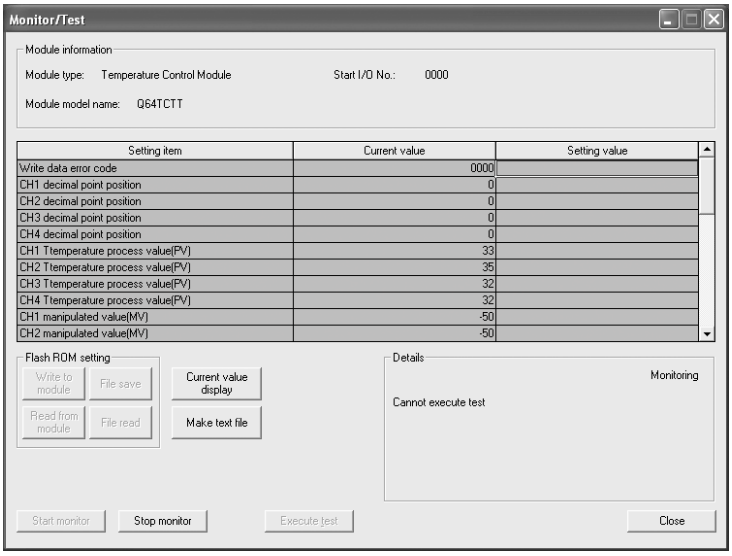
Select monitor/test module screen



Monitor/test

Enter "Start I/O No.", then select "Package name" and "Module model name".

Monitor/test screen



See Section 5.6

5.3.3 Starting the intelligent function utility

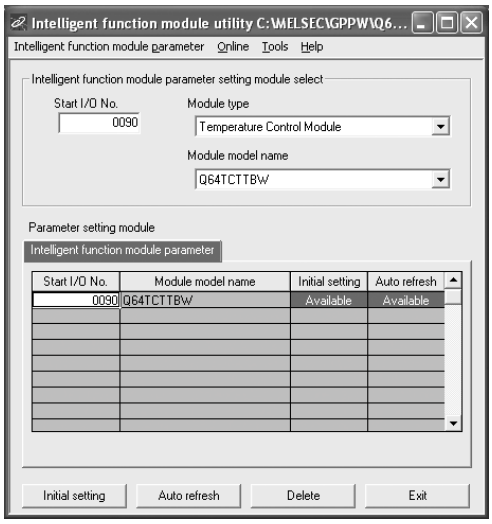
[Purpose of operation]

Start the utility from GX Developer, and display the intelligent module parameter setting module selection screen. The initial setting, auto refresh and select monitor/test module (selecting the module for which monitoring/testing is to be performed) screens can be started from this screen.

[Startup procedure]

[Tools] → [Intelligent function utility] → [Start]

[Setting screen]



[Explanation of items]

(1) How to start each screen

(a) Starting the initial setting
"Start I/O No.＊" → "Package name" → "Module model name" →
Initial setting

(b) Starting the auto refresh setting
"Start I/O No.＊" → "Package name"→ "Module model name"→
Auto refresh

(c) Select monitor/test module screen
[Online] → [Monitor/test]

＊ Enter the start I/O No. in hexadecimal.

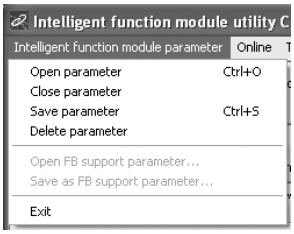
(2) Explanation of the screen command buttons

Delete	Deletes the initial settings and auto refresh setting for the selected module.
Exit	Ends the intelligent module parameter setting module selection screen.

(3) Menu bar

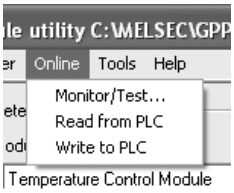
(a) File items

File operations are performed for the intelligent module parameters for the project opened by GX Developer.



[Open file] : Opens the parameter file.
[Close file] : Closes the parameter file. If changes have been made, the dialog box asking whether to save the file appears.
[Save file] : Saves the parameter file.
[Delete file] : Deletes the parameter file.
[Exit] : Ends the intelligent module parameter setting module selection screen.

(b) Online items



[Monitor/test] : Starts the select monitor/test module screen.
[Read from PLC] : Reads the intelligent module parameters from the CPU module.
[Write to PLC] : Writes the intelligent module parameters to the CPU module.

POINT

(1) Saving the intelligent module parameter files

Since these files cannot be saved using the GX Developer's project save operation, save the files using the intelligent module parameter setting module selection screen mentioned above.

(2) Reading and writing the intelligent module parameters to and from a PLC using GX Developer.

(a) Once the intelligent module parameters are saved in a file, they can be read from and written to the PLC.

(b) Set the target PLC CPU using [Online] → [Transfer setup] of GX Developer.

(c) When mounting the Q64TC on a remote I/O station, use Read from PLC and Write to PLC of GX Developer.

(3) Checking for the required utility

Start I/O No. is displayed in the Intelligent function module utility setting screen, but a "*" may be displayed for the model name.

This means that either the required utility is not installed or that the utility cannot be started from the GX Developer.

Check for the required utility in [Tools] - [Intelligent function utility] - [Utility list ...] in GX Developer, and set it.

5.4 Initial Settings

[Purpose of operation]

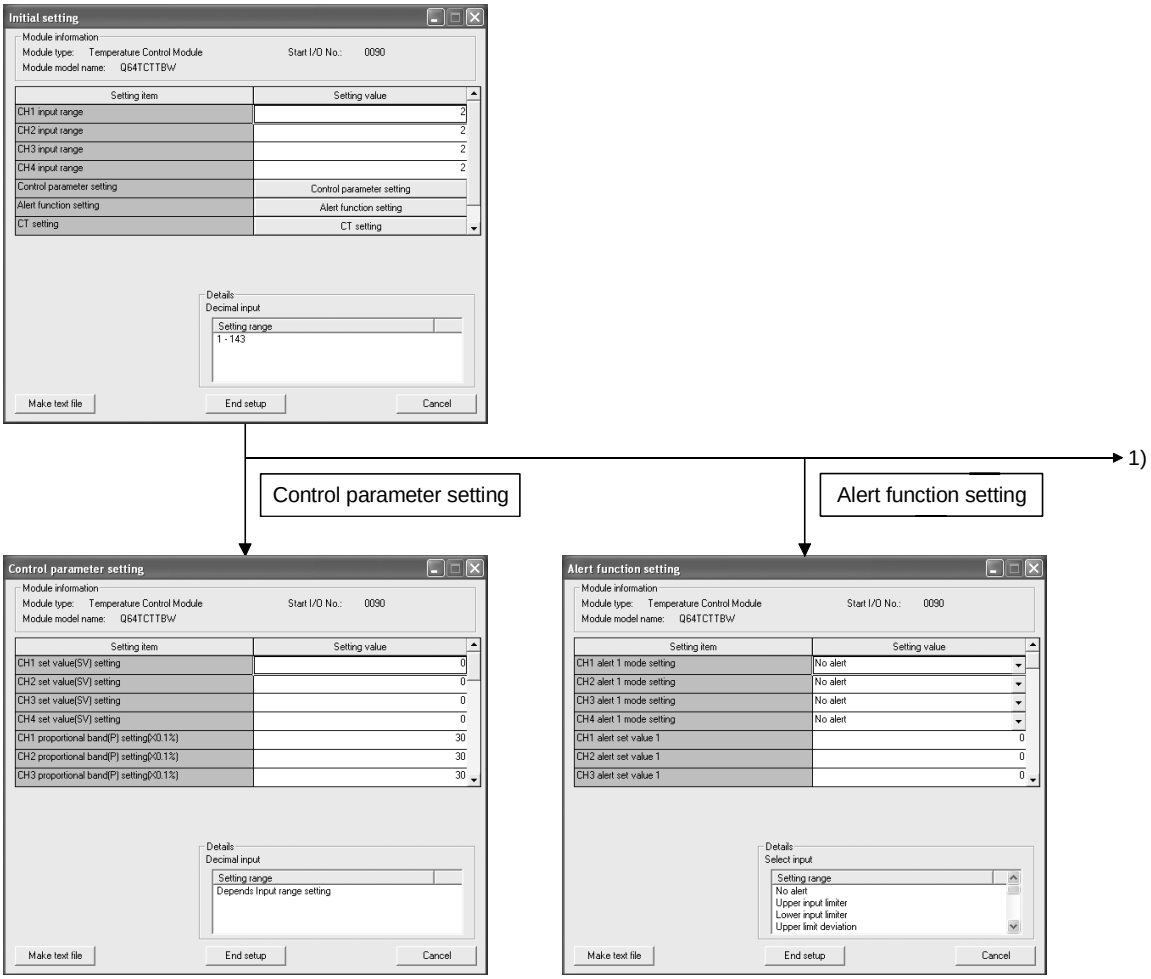
Make initial setting for operating the temperature control module channel-by-channel.
Refer to Section 5.1 for the initial setting parameter types.
Sequence program setting will be made unnecessary by making this initial setting.

[Startup procedure]

Choose "Start I/O No.＊" → "Package name" → "Module model name" → Initial setting

＊ Enter the start I/O No. in hexadecimal.

[Setting screen]

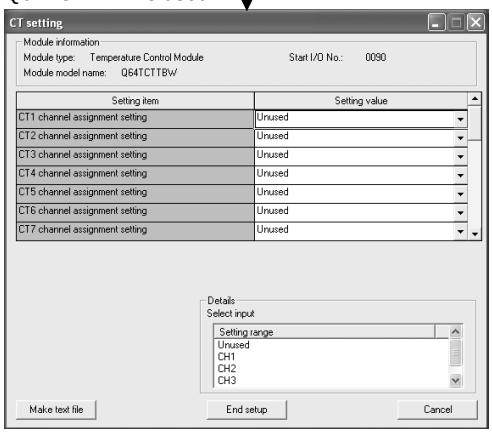


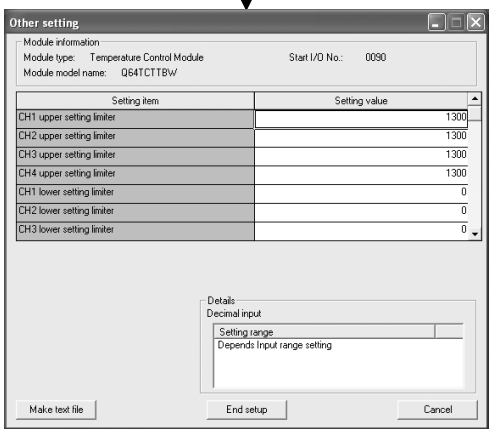
1)

May be selected only when Q64TCTTBW or Q64TCRTBW is used

CT setting

Other setting





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[Explanation of items]

(1) Explanation of the command buttons

Make text file	Outputs the screen display in a text file format.
End setup	Confirms the entry of set data and ends the operation.
Cancel	Cancels the set data and ends the operation.

POINT

Initial settings are stored in the intelligent module parameters. After being written to the CPU module, the initial setting is made effective by either (1) or (2).

(1) Cycle the RUN/STOP switch of the CPU module: STOP → RUN → STOP → RUN.

(2) With the RUN/STOP switch set to RUN, turn off and then on the power or reset the CPU module.

If the initialization settings have been written by a sequence program, the initialization settings will be executed during the STOP → RUN of the CPU module. Arrange so that the initial settings written by the sequence program are re-executed during the STOP → RUN of the CPU module.

5.5 Auto Refresh

[Purpose of operation]

Set the Q64TC buffer memory to be automatically refreshed, for each channel. Refer to Section 5.1 for the automatic refresh setting types.

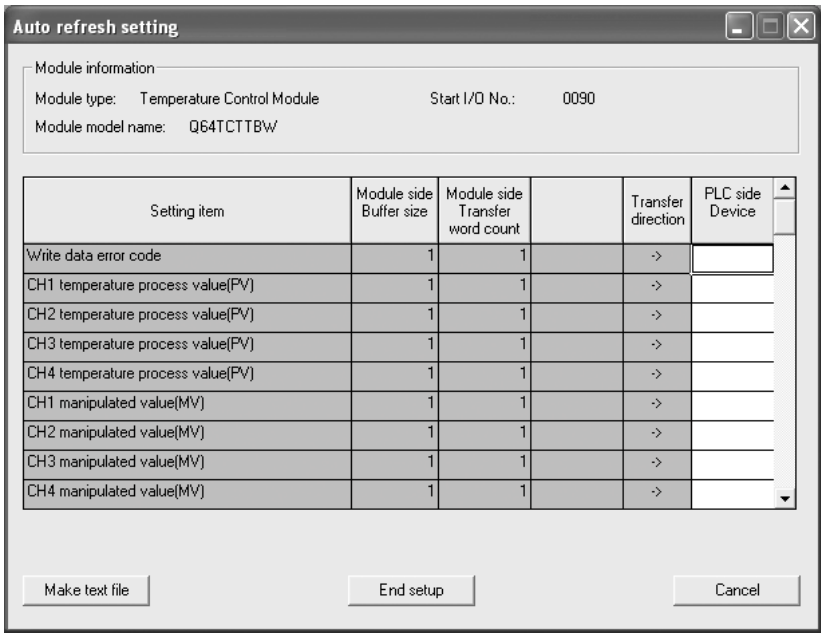
These auto refresh settings eliminate the need for reading by a sequence program.

[Startup procedure]

"Start I/O No.＊" → "Package name" → "Module model name" → Auto refresh

＊ Enter the start I/O No. in hexadecimal.

[Setting screen]



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[Explanation of items]

(1) Contents of the screen display

Module side buffer size	: Displays the size of the setting item buffer memory.
Module side transfer word count	: Displays the number of words to transfer.
Transfer direction	: "←" indicates that data at the PLC CPU side is written to the buffer memory. "→" indicates that data is read from the buffer memory to the PLC CPU side.
PLC side device	: Enter the device at the CPU module to be automatically refreshed. The devices that can be used include X, Y, M, L, B, T, C, ST, D, W, R, and ZR. When using bit devices, X, Y, M, L or B, set a number that can be divided by 16 points (examples: X10, Y120, M16). Also, buffer memory data is stored in 16-point portions starting with the device number that has been set. For example, if X10 is set, data will be stored to X10 through X1F.

(2) Explanation of the command buttons

Make text file	Creates a file containing the displayed screen data in a text file format.
End setup	Confirms the entry of set data and ends the operation.
Cancel	Cancels the set data and ends the operation.

POINTS

- The auto refresh settings are stored in the intelligent module parameters. Once the intelligent module parameters are written to the CPU module, they can be enabled by turning the power OFF and then ON, or resetting the CPU module.
- Auto refresh settings cannot be changed from the sequence program. However, it is possible to add a process similar to auto refresh by using the FROM/TO commands of the sequence program.

5.6 Monitor/Test

[Purpose of operation]

Start the buffer memory monitoring/testing, and I/O signals monitoring/testing from this screen.

[Startup procedure]

Select monitor/test module screen → "Start I/O No.＊" → "Package name" → "Module model name" → Monitor/test

＊ Enter the start I/O No. in hexadecimal.

The screen can also be started from the GX Developer Version 6 or later system monitor.
See GX Developer Operating Manual for details.

[Setting screen]

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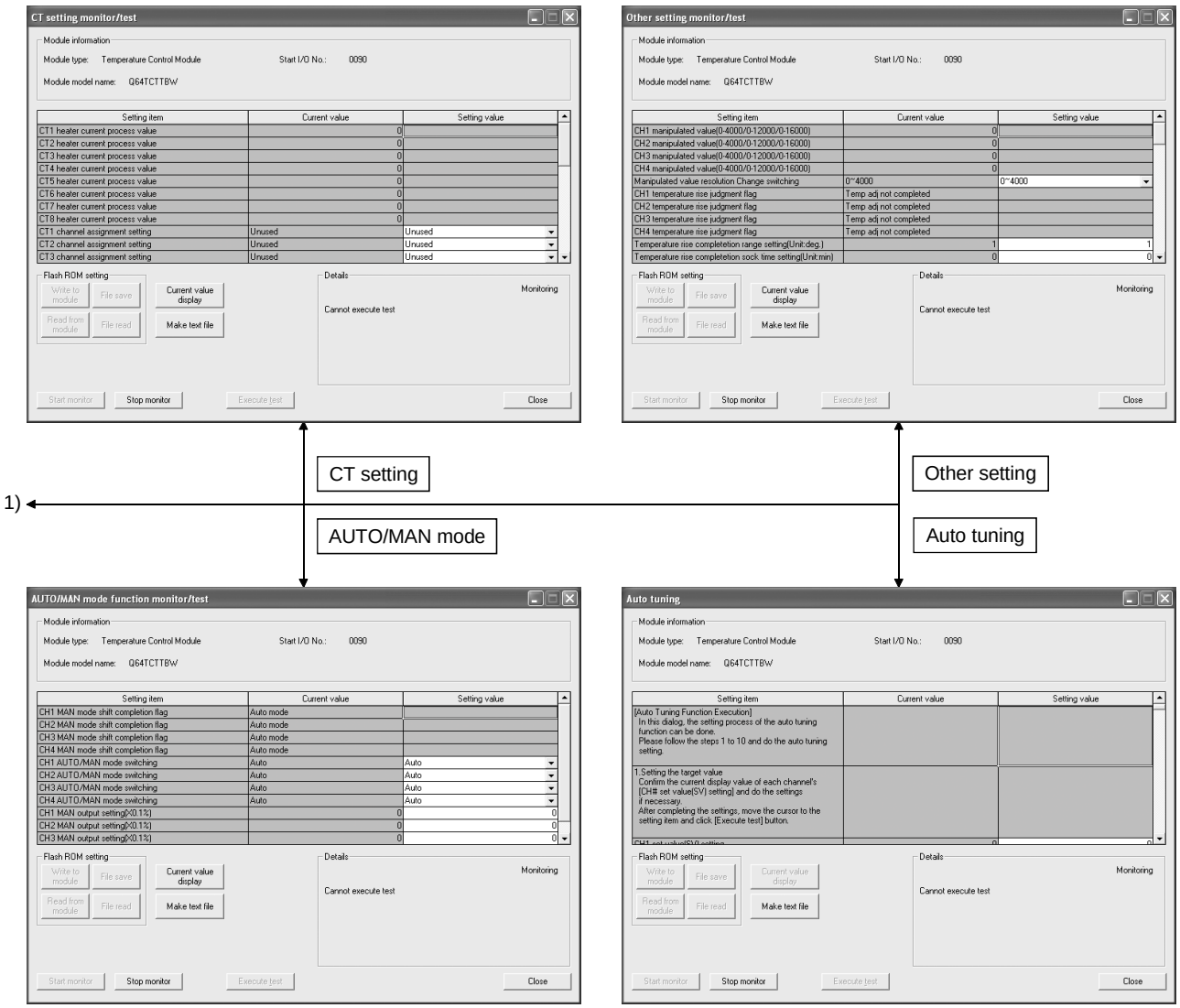

CT setting monitor/test
Other setting monitor/test
CT setting
Other setting
1)
AUTO/MAN mode
Auto tuning
AUTO/MAN mode function monitor/test
Auto tuning

[Explanation of items]

(1) Contents of the screen display

Setting item : Displays the I/O signal or buffer memory name.
Current value : Displays the I/O signal status or present buffer memory value for monitoring.
Setting value : Select or enter a value to be written to the buffer memory with a test operation.

(2) Explanation of the command buttons

Current value display	Displays the current value of the selected item. (This command button is used to check text that cannot be displayed in the current value field. However, in this utility package, all items can be displayed in the display fields).
Make text file	Makes a file consisting of the displayed screen contents in a text file format.
Start monitor / Stop monitor	Selects whether or not to monitor the current values.
Execute test	Tests the selected item. To select more than one item, select each additional item while holding down the Ctrl key.
Close	Closes the currently displayed screen and returns to the previously displayed screen.

REMARK

Selected test operation will be explained using write to CH.1 set value setting (SV) as an example.

(1) Click and choose the set value field of CH.1 set value setting (SV).

(2) After entering a value, press the Enter key.
At this point, the value is not yet written to the Q64TC.

(3) Click and choose the set value field for write to the Q64TC.
To write the value to more than one setting item at once, hold down the Ctrl key and perform selection operation.

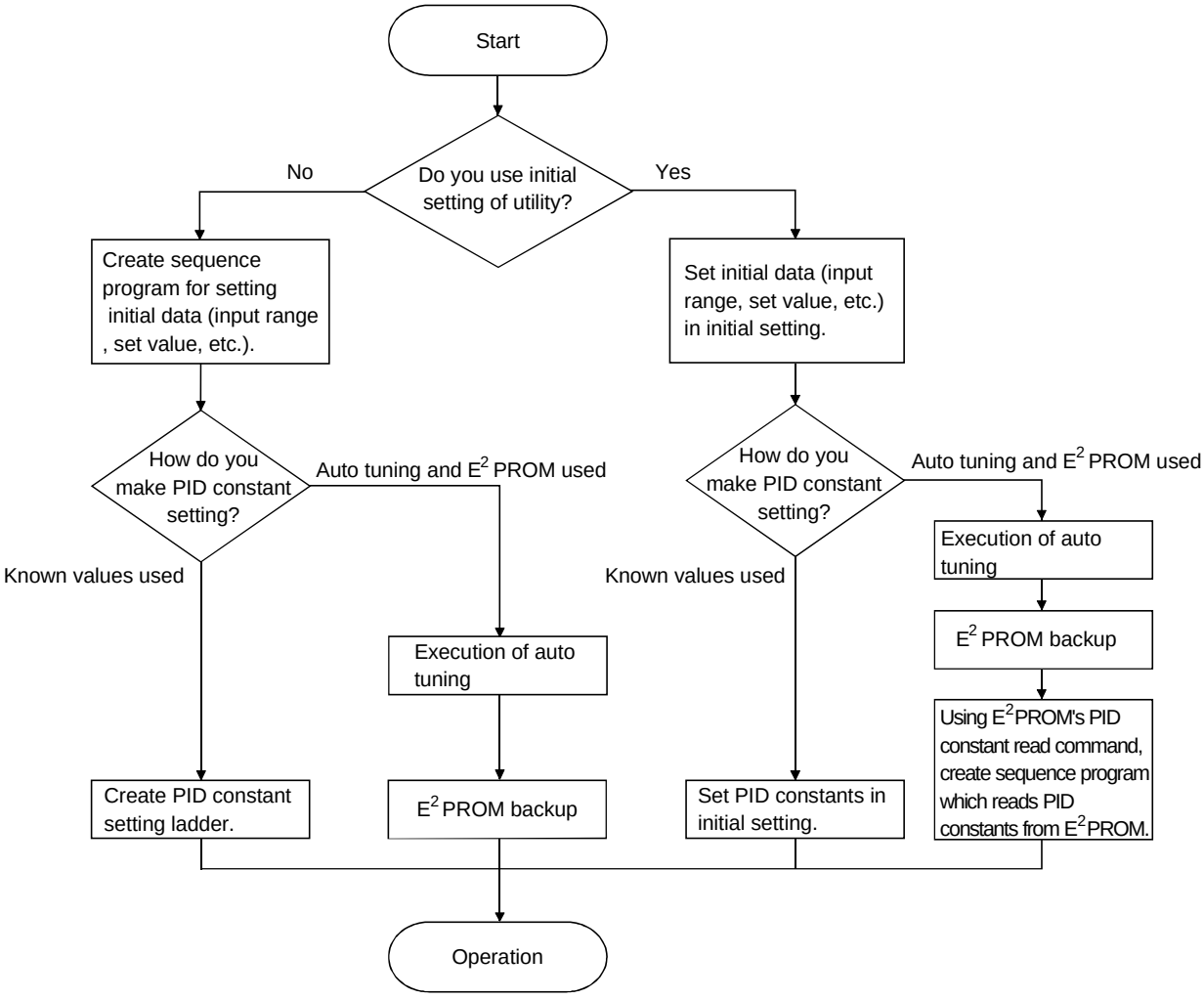
(4) Click Execute test to execute write.
On completion of write, the written value appears in the current value field.

6 PROGRAMMING

This chapter describes the programs of the Q64TC.
When applying any of the program examples introduced in this chapter to the actual system, verify the applicability and confirm that no problems will occur in the system control.

6.1 Programming Procedure

Create the programs for running the Q64TC to exercise temperature control in the following procedure.


Start
Do you use initial setting of utility?
No
Yes
Create sequence program for setting initial data (input range , set value, etc.).
Set initial data (input range, set value, etc.) in initial setting.
How do you make PID constant setting?
Auto tuning and E2 PROM used
Known values used
Execution of auto tuning
E2 PROM backup
Create PID constant setting ladder.
How do you make PID constant setting?
Auto tuning and E2 PROM used
Known values used
Execution of auto tuning
E2 PROM backup
Using E2 PROM's PID constant read command, create sequence program which reads PID constants from E2 PROM.
Set PID constants in initial setting.
Operation

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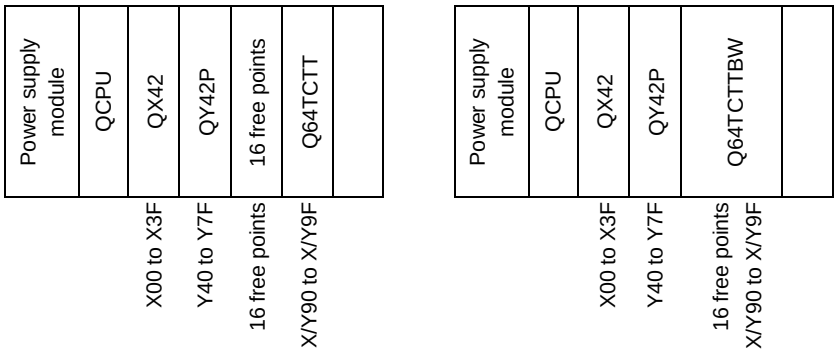
6.2 For Use in Normal System Configuration

System configuration for program explanation

(1) System configuration



Perform the following intelligent function module switch settings in advance.

- Switch 1 0030_H (CH1: CLEAR)
- Switch 2 Empty
- Switch 3 Empty
- Switch 4 Empty
- Switch 5 Empty

(2) Program conditions

The programs are written to read the temperatures measured by the thermocouple (K type) connected to channel 1.
They include write data error code reading and error code resetting programs.

(a) Contents of initial setting
- Used channel CH1
- CH1 Target Value Setting (SV) 200
- CH1 Warning1 Mode Setting..... UprLmt Input
- CH1 Warning Setting Value1..... 500
- CH1 Upper Limit Setting Limiter..... 400
- CH1 Lower Limit Setting Limiter..... 0

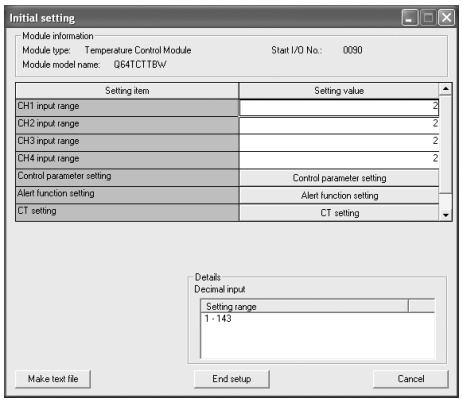
(b) Devices used by user
- Set value write command X0
- Auto tuning execution command (when GX Configurator-TC is not used)..... X1
- E^2PROM's PID constant read command (when GX Configurator-TC is used)..... X1
- Error code reset command..... X2
- Operation mode setting command X3
- Temperature detection value output (BCD 4 digits) ..... Y50 to Y5F
- Write data error code storage register..... D50(D150)
- Read temperature detection value storage register D51

6.2.1 Program example using the utility package

(1) Operation of utility package

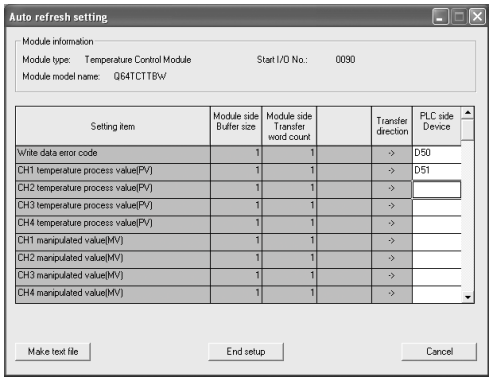
(a) Initial setting (Refer to Section 5.4)

CH1 Input Range......"2"
CH1 Target Value Setting (SV)....."200"
CH1 Warning1 Mode Setting....."UprLmt Input"
CH1 Warning Setting Value1....."500"
CH1 Upper Limit Setting Limiter....."400"
CH1 Lower Limit Setting Limiter....."0"
CH1 Unused Channel Setting....."Not Used"
CH2 Unused Channel Setting....."Not Used"
CH3 Unused Channel Setting....."Not Used"



(b) Automatic refresh setting (Refer to Section 5.5)

Data Write Error Code....."D50"
CH1 Measured Temperature Value (PV)....."D51"

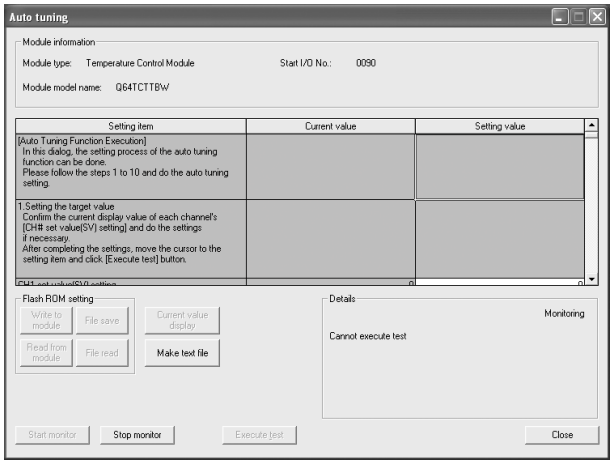


(c) Intelligent function module parameter write (Refer to Section 5.3.3)

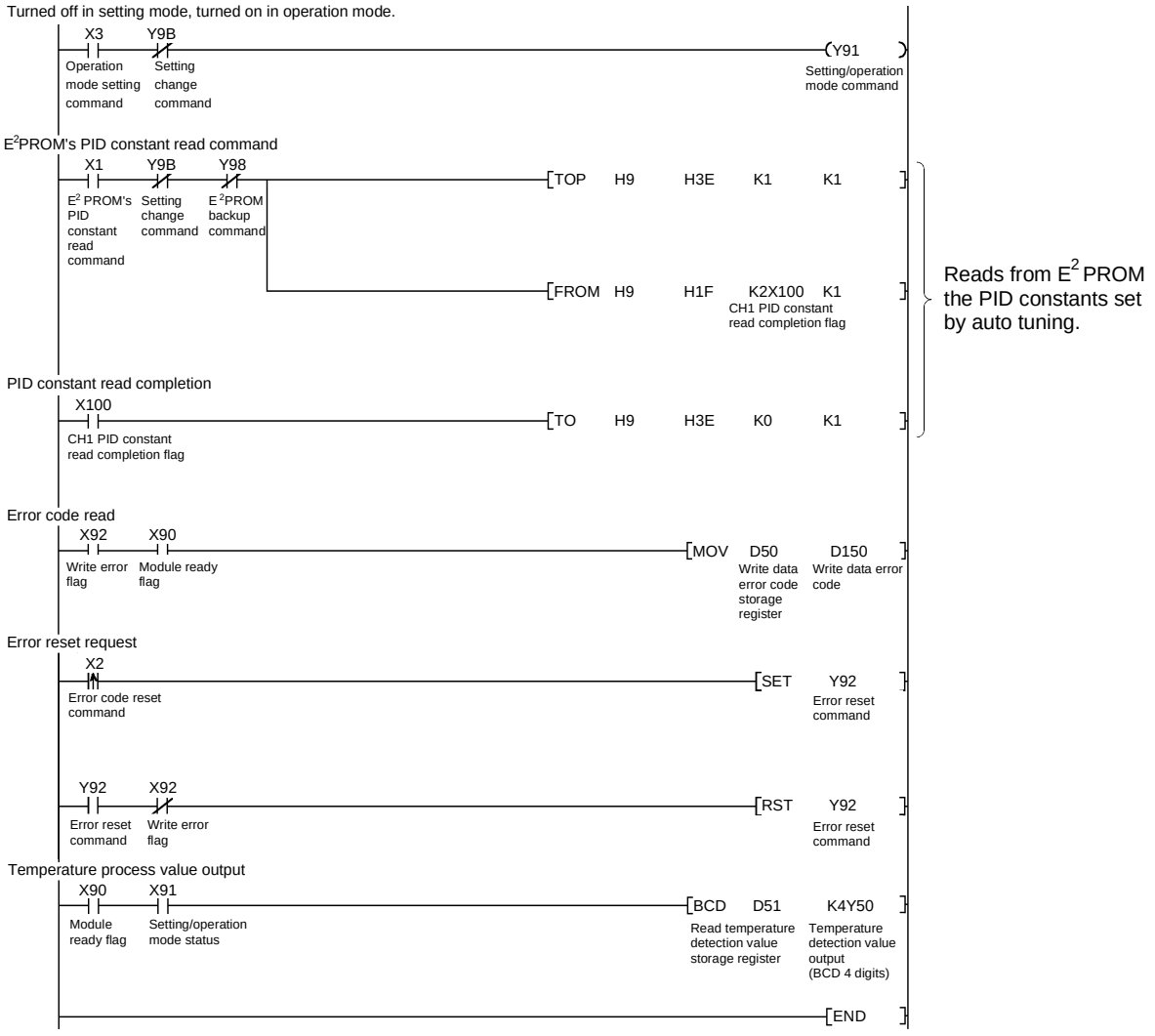
Write the parameter values of the intelligent function module to the PLC CPU.

Perform this operation on the parameter setting unit selection screen.

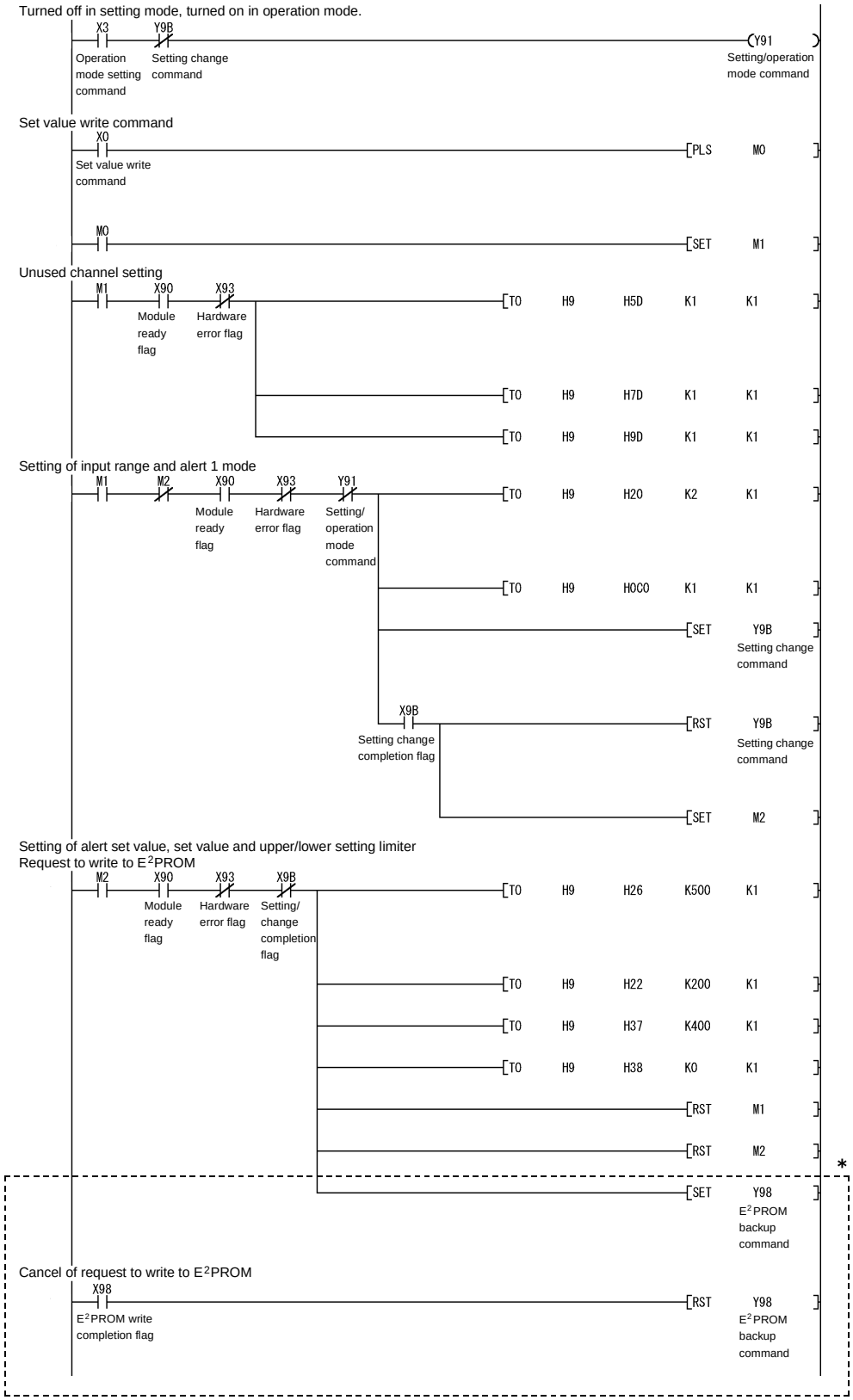
(d) Execution of auto tuning in monitor/test setting (Refer to Section 5.6)
Auto tuning is executed in the procedure shown on the screen.
CH1 EEPROM Auto Backup....."Yes"


Auto tuning
Module information
Module type: Temperature Control Module
Start I/O No.: 0090
Module model name: Q64TCTTBW
Setting item
Current value
Setting value
[Auto Tuning Function Execution]
In this dialog, the setting process of the auto tuning function can be done.
Please follow the steps 1 to 10 and do the auto tuning setting.
1.Setting the target value
Confirm the current display value of each channel's [CH# set value(SV) setting] and do the settings if necessary.
After completing the settings, move the cursor to the setting item and click [Execute test] button.
Flash ROM setting
Write to module
File save
Read from module
File read
Current value display
Make text file
Details
Monitoring
Cannot execute test
Start monitor
Stop monitor
Execute test
Close

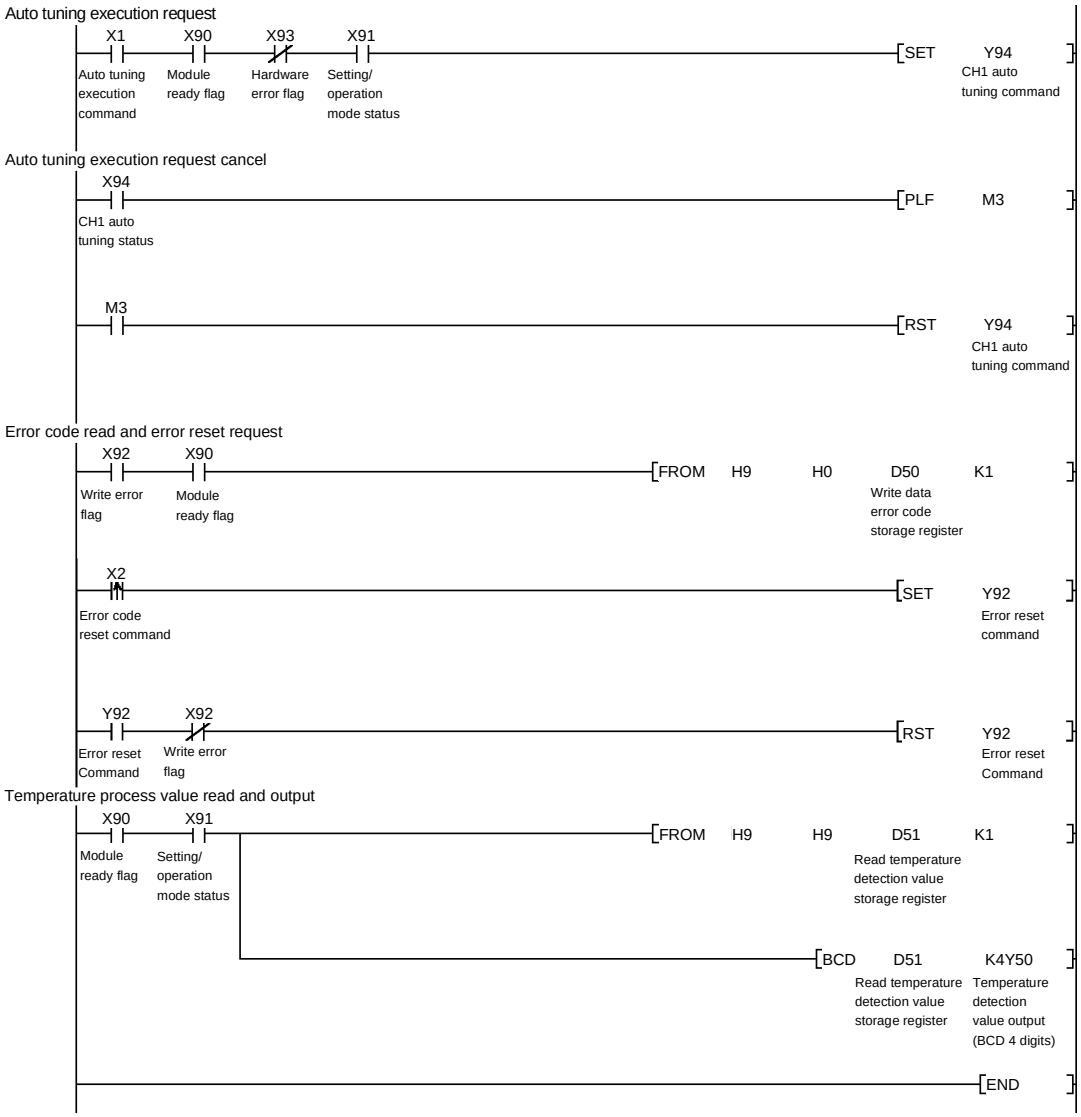
(2) Program example



6.2.2 Program example without using the utility package



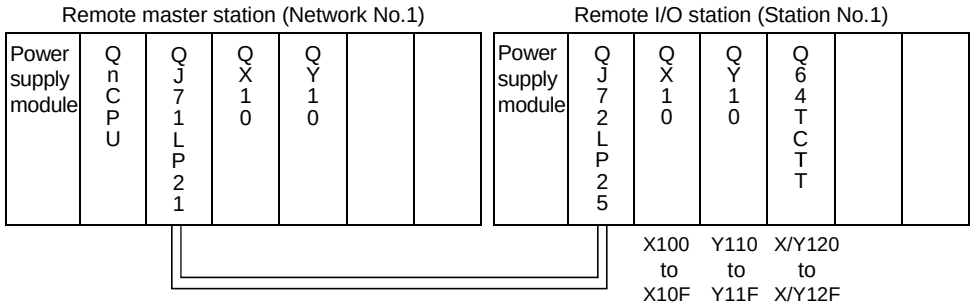
*: Needed when registering the set input range, alert setting, set value and others to E^2PROM. Write to E^2PROM is not needed when using GX Configurator-TC's initial setting or writing the input range, alert setting, set value and others using sequence program at power-on.


Auto tuning execution request
X1
Auto tuning execution command
X90
Module ready flag
X93
Hardware error flag
X91
Setting/ operation mode status
SET
Y94
CH1 auto tuning command
Auto tuning execution request cancel
X94
CH1 auto tuning status
PLF
M3
M3
RST
Y94
CH1 auto tuning command
Error code read and error reset request
X92
Write error flag
X90
Module ready flag
FROM
H9
H0
D50
Write data error code storage register
K1
X2
Error code reset command
SET
Y92
Error reset command
Y92
Error reset Command
X92
Write error flag
RST
Y92
Error reset Command
Temperature process value read and output
X90
Module ready flag
X91
Setting/ operation mode status
FROM
H9
H9
D51
Read temperature detection value storage register
K1
BCD
D51
Read temperature detection value storage register
K4Y50
Temperature detection value output (BCD 4 digits)
END

6.3 For Use on Remote I/O Network

System configuration used in the program explanation

(1) System configuration



Perform the following intelligent function module switch settings in advance.

- Switch 1 0030_H (CH1: CLEAR)
- Switch 2 Empty
- Switch 3 Empty
- Switch 4 Empty
- Switch 5 Empty

(2) Program conditions

The temperature measured by the thermocouple (K type) connected to CH1 is read to the PLC CPU of the remote master station.
They include write data error code reading and error code resetting programs.

(a) Initial settings

Used channel.....CH1
- CH1 Target Value Setting (SV) 200
- CH1 Warning1 Mode Setting.....UprLmt Input
- CH1 Warning Setting Value1.....500
- CH1 Upper Limit Setting Limiter.....400
- CH1 Lower Limit Setting Limiter.....0

(b) Devices used by user
- Set value write command X20
- Auto turning execution command (when GX Configulator-TC is not used) X21
- E^2PROM's PID constant read command (when GX Configulator-TC is used) X21
- Error code reset command.....X22
- Operation mode setting command.....X23
- Temperature detection value output (BCD 4 digits).....Y30 to Y3F
- Write data error code storage register.....D50 (W150)
- Read temperature detection value storage register D51 (W151)

POINT

For details on the MELSECNET/H remote I/O network, refer to the Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O Network).

6.3.1 Program example using the utility package

(1) Operating GX Developer

(a) Network parameter setting

- Network type : MNET/H (remote master)
- Head I/O No. : 0000H
- Network No. : 1
- Total number of (slave) stations : 1
- Mode : Online
- Network range assignment :

StationNo.	M station -> R station						M station <- R station					
	Y			Y			X			X		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1	256	0100	01FF	256	0000	00FF	256	0100	01FF	256	0000	00FF

StationNo.	M station -> R station			M station <- R station			M station -> R station			M station <- R station		
	B			B			W			W		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1							256	0000	00FF	256	0100	01FF

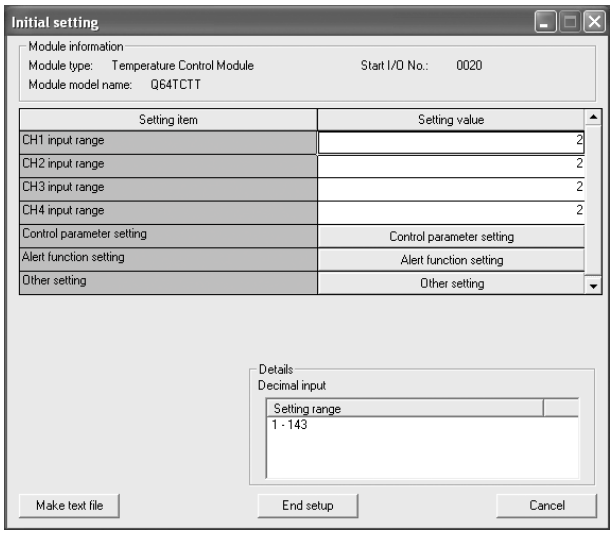
- Refresh parameters :

	Link side					PLC side			
	Dev. name	Points	Start	End		Dev. name	Points	Start	End
Transfer SB	SB	512	0000	01FF	⇔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	⇔	SW	512	0000	01FF
Random cyclic	LB				⇔				
Random cyclic	LW				⇔				
Transfer1	LB	8192	0000	1FFF	⇔	B	8192	0000	1FFF
Transfer2	LW	8192	0000	1FFF	⇔	W	8192	0000	1FFF
Transfer3	LX	512	0000	01FF	⇔	X	512	0000	01FF
Transfer4	LY	512	0000	01FF	⇔	Y	512	0000	01FF
Transfer5					⇔				
Transfer6					⇔				

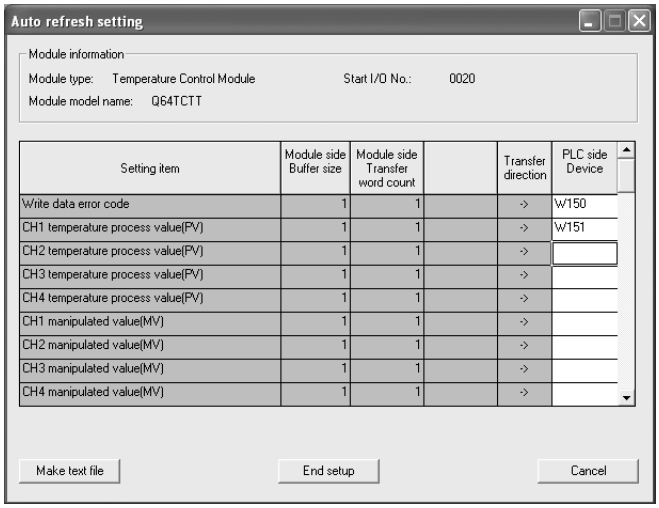
(2) Operating the utility package

(a) Initial setting (Refer to Section 5.4)

CH1 Input Range ..... "2"
CH1 Target Value Setting (SV) ..... "200"
CH1 Warning1 Mode Setting..... "UprLmt Input"
CH1 Warning Setting Value1 ..... "500"
CH1 Upper Limit Setting Limiter..... "400"
CH1 Lower Limit Setting Limiter..... "0"
CH2 Unused Channel Setting ..... "Not Used"
CH3 Unused Channel Setting ..... "Not Used"
CH4 Unused Channel Setting..... "Not Used"

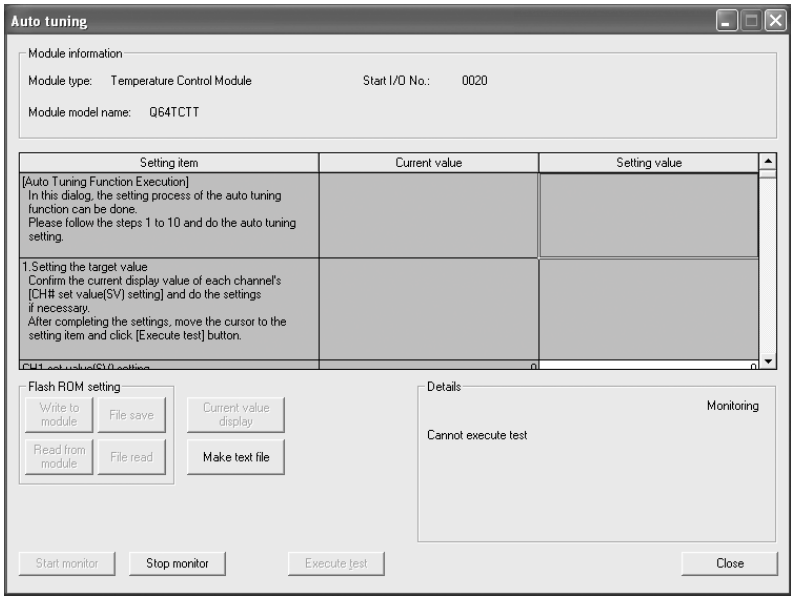


(b) Automatic refresh setting (Refer to Section 5.5)
Data Write Error Code....."W150"
CH1 Measured Temperature Value (PV)....."W151"

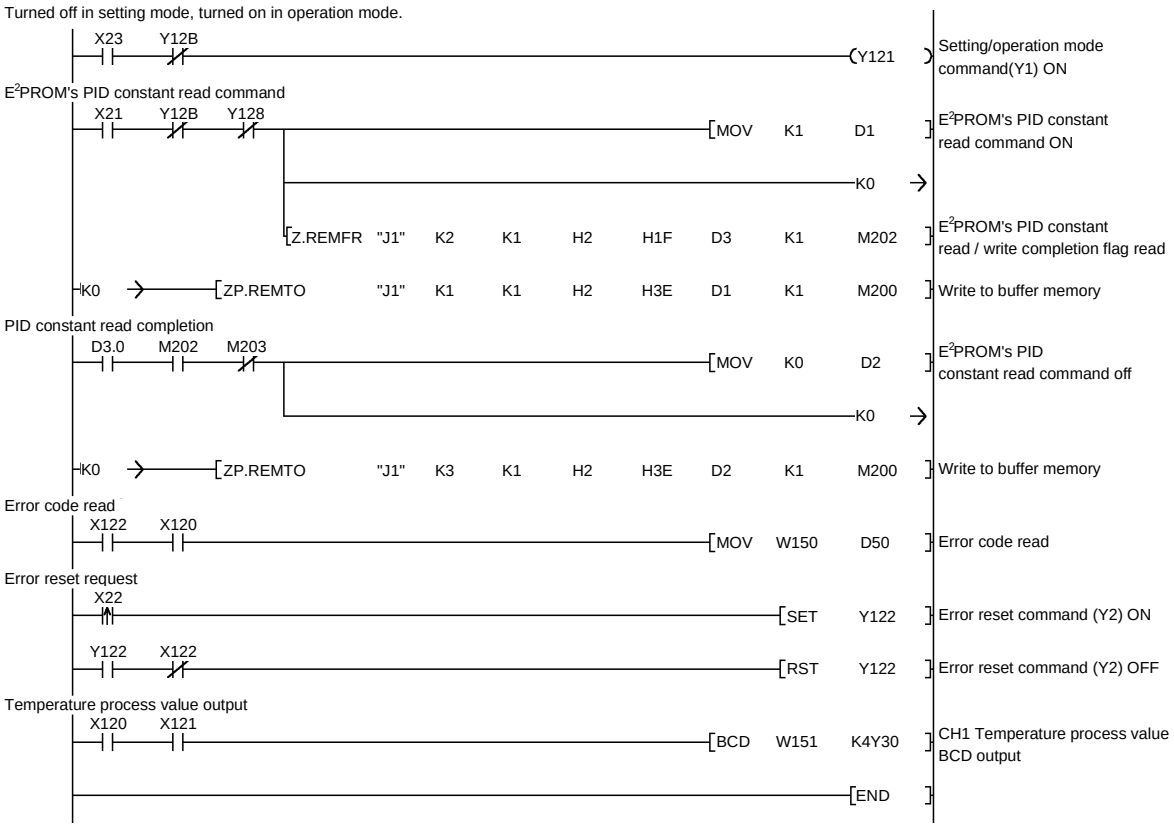


(c) Intelligent function module parameter write (Refer to Section 5.3.3)
The intelligent function module parameters are written to the remote I/O station.
Perform this operation on the parameter setting unit selection screen.

(d) Execution of auto tuning in monitor/test setting (Refer to Section 5.6)
Auto tuning is executed in the procedure shown on the screen.
CH1 EEPROM Auto Backup....."Yes"


Auto tuning
Module information
Module type: Temperature Control Module
Start I/O No.: 0020
Module model name: Q64TCTT
Setting item
Current value
Setting value
[Auto Tuning Function Execution]
In this dialog, the setting process of the auto tuning function can be done.
Please follow the steps 1 to 10 and do the auto tuning setting.
1.Setting the target value
Confirm the current display value of each channel's [CH# set value(SV) setting] and do the settings if necessary.
After completing the settings, move the cursor to the setting item and click [Execute test] button.
Flash ROM setting
Write to module
File save
Read from module
File read
Current value display
Make text file
Details
Monitoring
Cannot execute test
Start monitor
Stop monitor
Execute test
Close

(3) Program example



POINT

To write the intelligent function module parameters, set the target remote I/O station from [Online] - [Transfer setup] on GX Developer.
They can be written by:

- Directly connecting GX Developer to the remote I/O station.
- Connecting GX Developer to another device such as a CPU module and passing through the network.

6.3.2 Program example without using the utility package

(1) Operation of GX Developer (Network parameter setting)

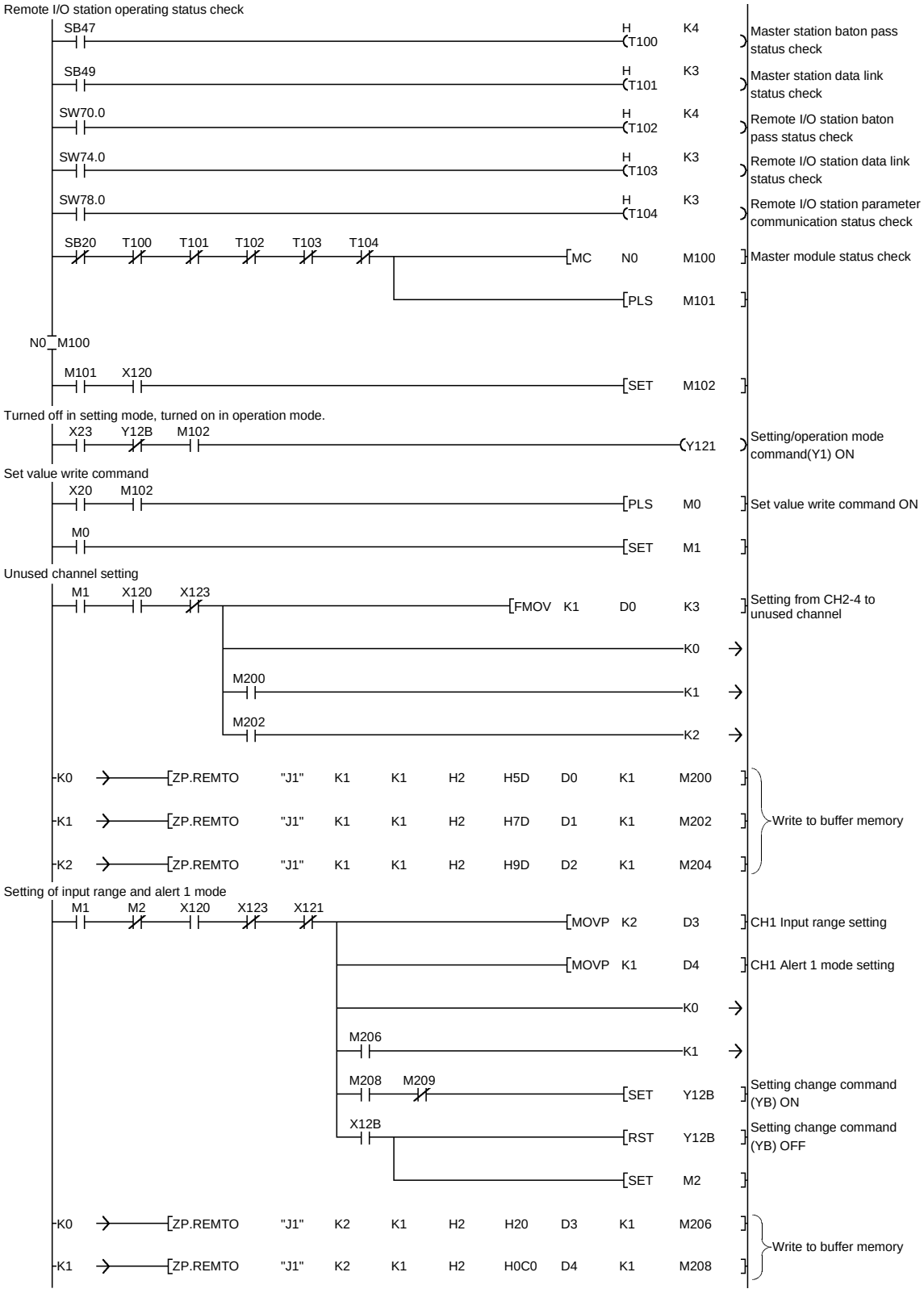
- Network type : MNET/H (remote master)
- Head I/O No. : 0000H
- Network No. : 1
- Total number of (slave) stations : 1
- Mode : Online
- Network range assignment :

StationNo.	M station -> R station						M station <- R station					
	Y			Y			X			X		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1	256	0100	01FF	256	0000	00FF	256	0100	01FF	256	0000	00FF

- Refresh parameters :

	Link side					PLC side			
	Dev. name	Points	Start	End		Dev. name	Points	Start	End
Transfer SB	SB	512	0000	01FF	↔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	↔	SW	512	0000	01FF
Random cyclic	LB				↔				
Random cyclic	LW				↔				
Transfer1	LB	8192	0000	1FFF	↔	B	8192	0000	1FFF
Transfer2	LW	8192	0000	1FFF	↔	W	8192	0000	1FFF
Transfer3	LX	512	0000	01FF	↔	X	512	0000	01FF
Transfer4	LY	512	0000	01FF	↔	Y	512	0000	01FF
Transfer5					↔				
Transfer6					↔				

(2) Program example



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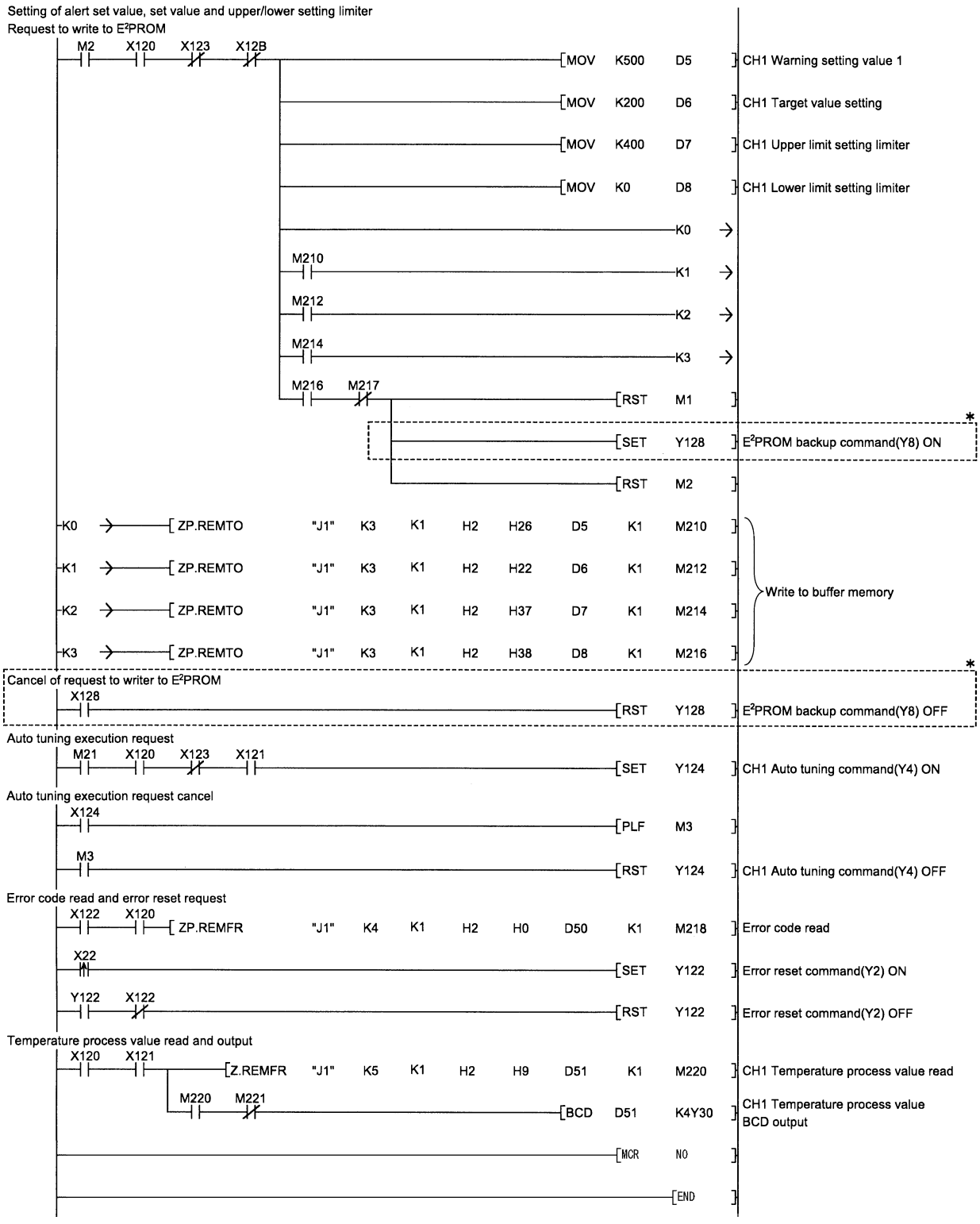


*: Needed when registering the set input range, alert setting, set value and others to E²PROM.
Write to E²PROM is not needed when using GX Configurator-TC's initial setting or writing the input range, alert setting, set value and others using sequence program at power-on.

7 ONLINE MODULE CHANGE

When changing a module online, carefully read the QCPU User's Manual (Hardware Design, Maintenance and Inspection), section 12.4.1 "Online module change".
This chapter describes the specifications of an online module change.

(1) Perform an online module change by operating GX Developer.

(2) When you want to continue the pre-change operation with the new module after an online module change, save/restore the buffer memory contents.

POINT

(1) Perform an online module change after making sure that the system outside the PLC will not malfunction.

(2) To prevent an electric shock and malfunction of operating modules, provide means such as switches for powering off each of the external power supply and external devices connected to the module to be replaced online.

(3) After the module becomes faulty, the data may not be saved properly.
Therefore, prerecord the data to be saved (the whole buffer memory contents that can be written, see Section 3.5.1).

(4) It is recommended to perform an online module change in the actual system in advance to ensure that it would not affect the other modules by checking the following:
- Means of cutting off the connection to external devices and its configuration are correct.
- Switching ON/OFF does not bring any undesirable effect.

(5) Do not mount/remove the module onto/from base unit more than 50 times (IEC 61131-2-compliant), after the first use of the product.
Failure to do so may cause the module to malfunction due to poor contact of connector.

7 - 1

7.1 Online Module Change Conditions

The PLC CPU, MELSECNET/H remote I/O module, Q64TC, GX Developer and base unit given below are needed to perform an online module change.

(1) PLC CPU

The Q12PHCPU or Q25PHCPU is needed.
For precautions for multiple PLC system configuration, refer to the Process CPU User's Manual (Function Explanation/Program Fundamentals).

(2) MELSECNET/H remote I/O module

The module of function version D or later is necessary.

(3) Q64TC

The module of function version C or later is necessary.

(4) GX Developer

GX Developer of Version 7.10L or later is necessary.
GX Developer of Version 8.18U or later is required to perform an online module change on the remote I/O station.

(5) Base unit

1) When the slim type main base unit (Q3□SB) is used, an online module change cannot be performed.
2) When the power supply module unnecessary type extension base unit (Q5□B) is used, online module change cannot be performed for the modules on all the base units connected.

7.2 Online Module Change Operations

The following gives the operations performed for an online module change.

PLC CPU operation ○: Executed ×: Not executed					(User operation) ＊3	(Intelligent function module operation)
X/Y refresh	FROM/TO instruction ＊1	Device test	GX Configurator: Initial setting parameter	GX Configurator: Monitor/test		
○	○	○	×	○	(1) Operation stop Turn OFF all Y signals that were turned ON by a sequence program. (2) Dismounting of module Operate GX Developer to start an online module change. Click the [Execution] button of GX Developer to make the module dismountable. Dismount the corresponding module. (3) Mounting of new module Mount a new module. After mounting the module, click the [Execution] button of GX Developer.	Module is operating as usual. Module stops operating. • RUN LED turns off. X/Y refresh resumes and the module starts. • RUN LED turns on. • Default operation (X0 remains OFF) When there are initial setting parameters, operation is performed according to the initial setting parameters at this point.
×	×	×	×	×		
○	×	×	○	×		
○	×	○	×	○	Operation check before control start (4) Operation check Click the [Cancel] button of GX Developer to leave the online mode. Conduct an operation test on the new module using "Device test" of GX Developer or "Monitor/test" of GX Configurator. Operation check completed (5) Resumption of control Operate GX Developer to resume the online module change mode, and click the Execution of button to resume control.	Module operates according to test operation＊2 X0 (Module Ready) turns ON. Start is made when X0 turns from OFF to ON. Operation is performed according to the initial setting sequence.＊2
○	○	○	×	○		

＊1: Access to the intelligent function module device (U□\G□) is included.

＊2: In the absence of the operation marked ＊2, the operation of the intelligent function module is the operation performed prior to that.

＊3: The item numbers (1) to (5) correspond to the operation step numbers of "Section 7.3 Online module change procedure".

7.3 Online Module Change Procedure

The online module change procedure is explained separately for the case where GX Configurator-TC was used for initial setting and for the case where a sequence program was used for initial setting.

7.3.1 GX Configurator-TC was used for initial setting

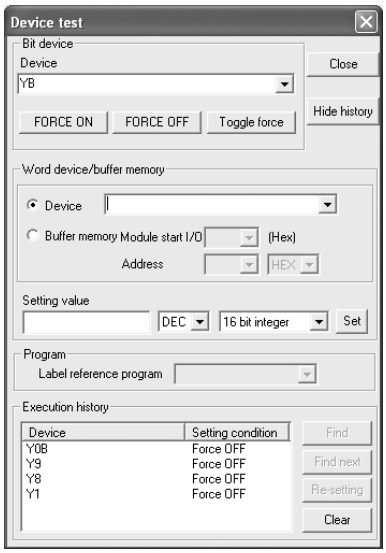
(1) Operation stop

(a) Turn off the following output signals to stop module operation.

Device No.	Signal name
Yn1	Setting/operation mode command
Yn8	E^2PROM backup command
Yn9	Default setting registration command
YnB	Setting change command

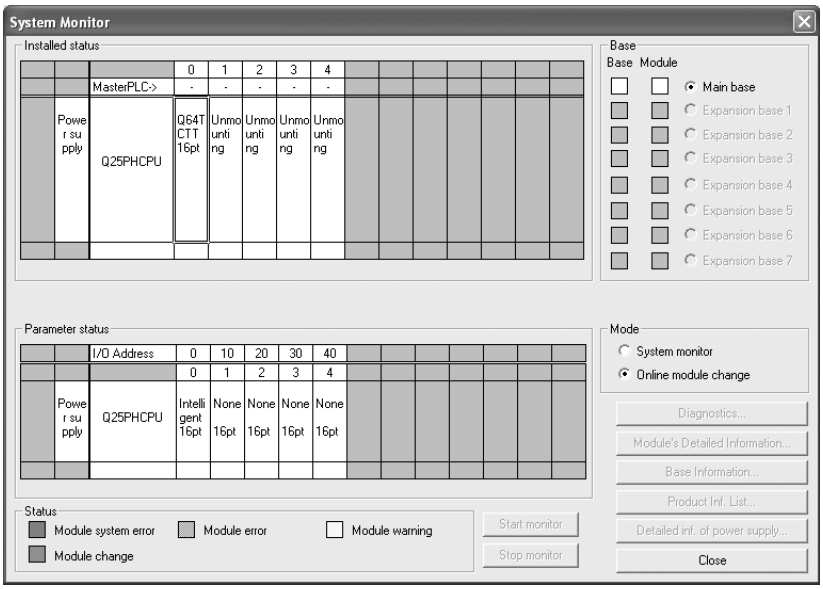
POINT

Control may not stop if only the setting/operation mode command (Yn1) is turned off. To stop control without fail, set the PID continuation flag (buffer memory address A9H: Un\G169) for 0 (stop) and turn off the setting/operation mode command (Yn1). To confirm that control has stopped, make sure that the setting/operation mode status (Xn1) is off.

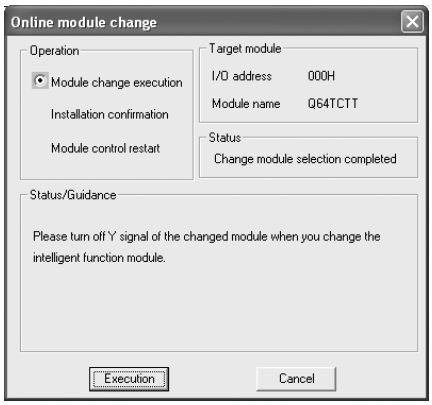


(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" screen.



(b) Click the "Execution" button to enable a module change.



If the following error screen appears, click the "OK" button and perform the operation in (2)(c) and later.

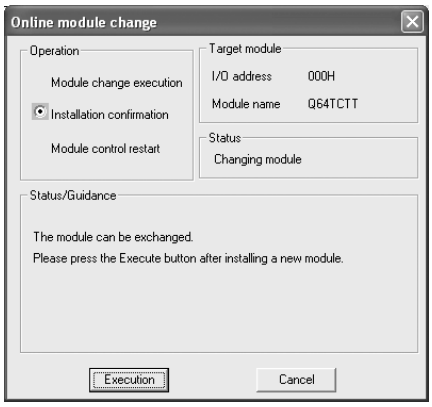
(c) After confirming that the "RUN" LED of the module has turned off, disconnect the external wiring and dismount the module.

POINT
(1) If you have removed the wiring together with the terminal block, the temperature measurement values may vary within the accuracy range due to the error of the specific cold junction temperature compensation resistor. (Q64TCTT, Q64TCTTBW only) (2) Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

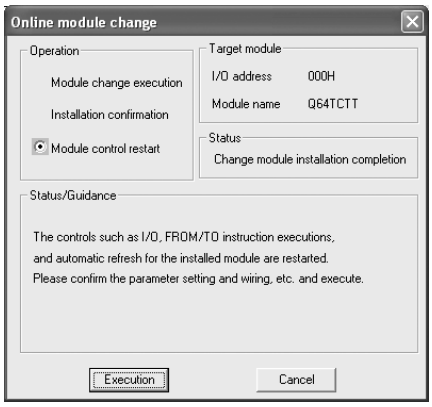
(a) Mount a new module to the same slot and connect the external wiring.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module Ready Flag (X0) remains OFF.

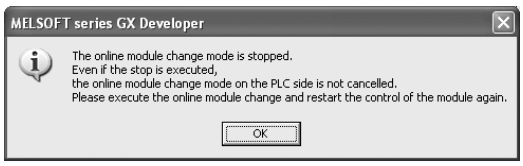


(4) Operation check

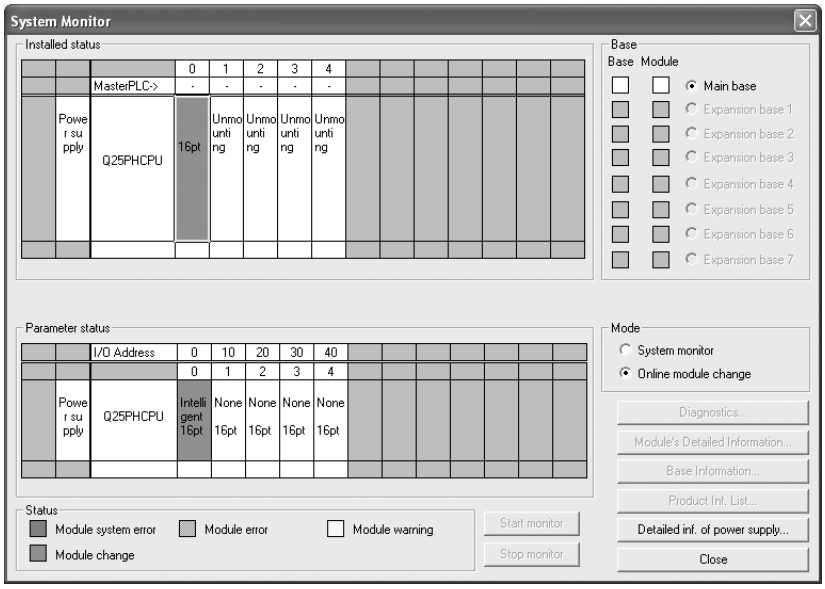
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.


MELSOFT series GX Developer
The online module change mode is stopped.
Even if the stop is executed,
the online module change mode on the PLC side is not cancelled.
Please execute the online module change and restart the control of the module again.
OK

(c) Click the [Close] button to close the System monitor screen.

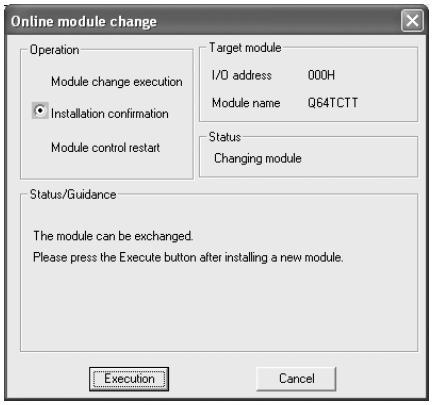


(d) Before resuming control, check the Q64TC for the following items. If any fault is found, refer to Chapter 8 and take corrective action.

1) The RUN LED is on.
2) The ERR. LED is off.
3) The write error flag (Xn2) is off.
4) The hardware error flag (Xn3) is off.

(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" screen, click the [Execution] button to resume control. The FROM/TO instruction for the module resumes.



(b) The "Online module change completed" screen appears.

7.3.2 Sequence program was used for initial setting

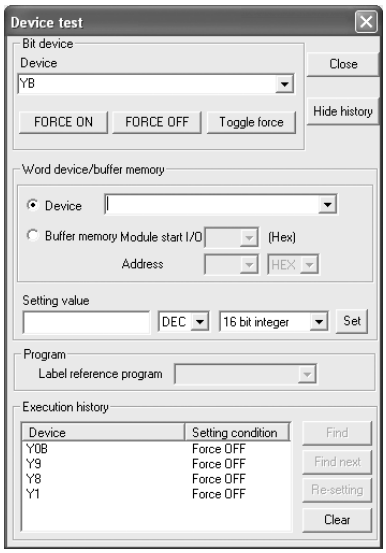
(1) Conversion disable

(a) Turn off the following output signals to stop module operation.

Device No.	Signal name
Yn1	Setting/operation mode command
Yn8	E^2PROM backup command
Yn9	Default setting registration command
YnB	Setting change command

POINT

Control may not stop if only the setting/operation mode command (Yn1) is turned off. To stop control without fail, set the PID continuation flag (buffer memory address A9H: Un*G169) for 0 (stop) and turn off the setting/operation mode command (Yn1). To confirm that control has stopped, make sure that the setting/operation mode status (Xn1) is off.



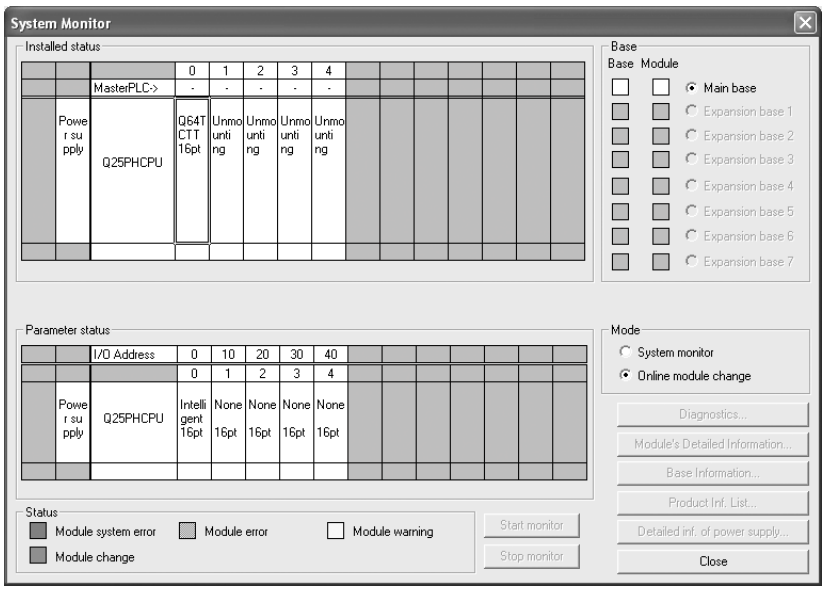
(b) If the buffer memory contents to be saved are not yet prerecorded, choose "Online" - "Monitor" - "" on GX Developer to monitor the buffer memory and record the values.

POINT

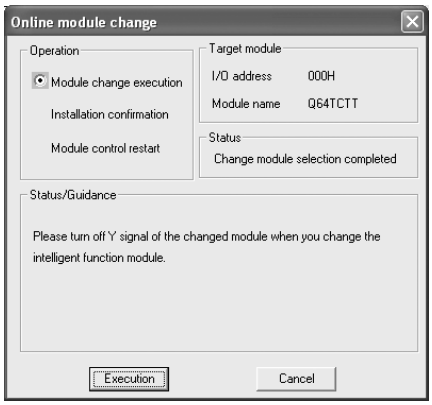
If a CPU continuation error (e.g. SP. UNIT DOWN, UNIT VERIFY ERR.) has occurred due to the fault of the module to be changed, the buffer memory contents cannot be saved.

(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" screen.



(b) Click the "Execution" button to enable a module change.



If the following error screen appears, click the [OK] button, dismount the module as-is, and mount a new module.

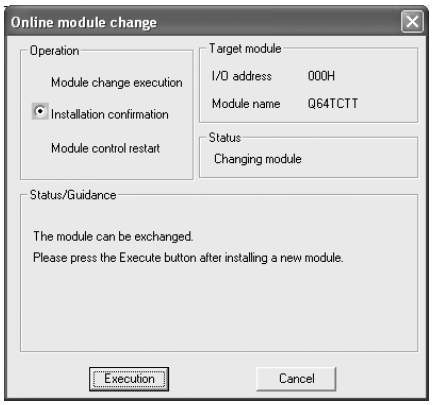
(c) After confirming that the "RUN" LED of the module has turned off, disconnect the external wiring and dismount the module.

POINT
(1) If you have removed the wiring together with the terminal block, the temperature measurement values may vary within the accuracy range due to the error of the specific cold junction temperature compensation resistor. (Q64TCTT, Q64TCTTBW only) (2) Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

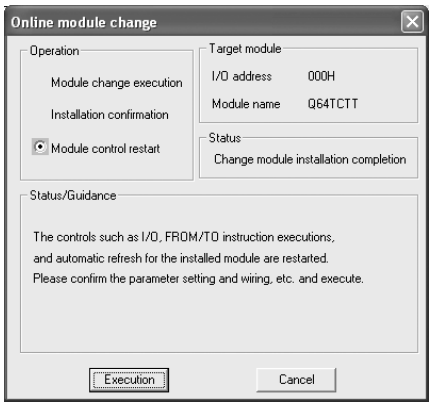
(a) Mount a new module to the same slot and connect the external wiring.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module Ready Flag (X0) remains OFF.

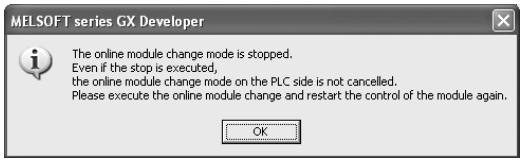


(4) Operation check

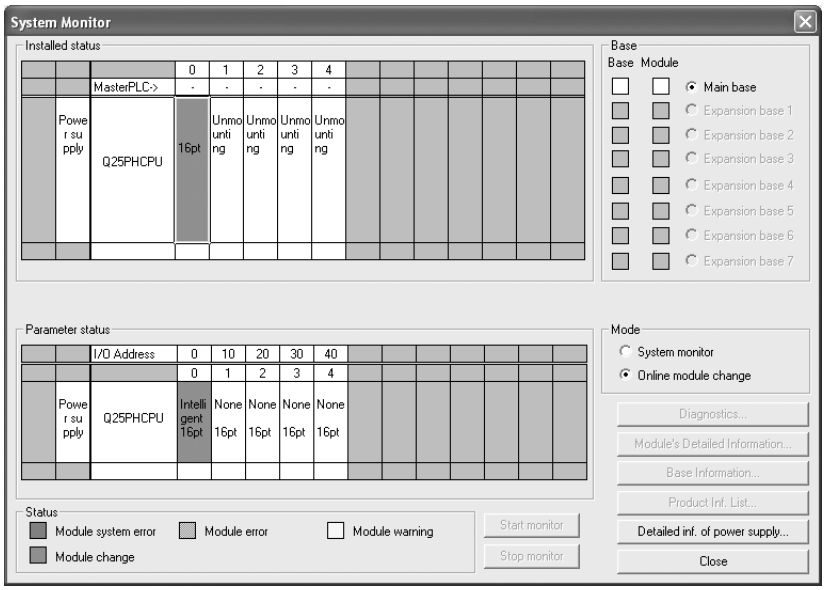
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.


MELSOFT series GX Developer
The online module change mode is stopped.
Even if the stop is executed,
the online module change mode on the PLC side is not cancelled.
Please execute the online module change and restart the control of the module again.
OK

(c) Click the [Close] button to close the System monitor screen.



(d) Choose "Online" - "Debug" - "Device test" on GX Developer to set the prerecorded values to the buffer memory.

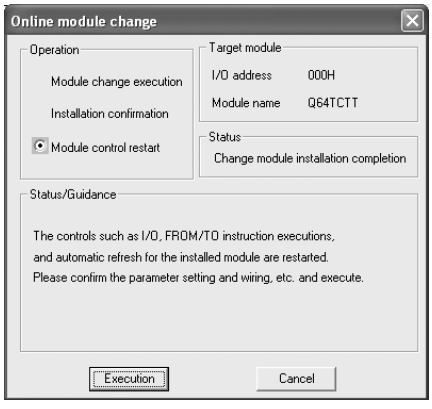
(e) To back up the data on the E^2PROM, turn the E^2PROM backup command (Yn8) from OFF to ON to write the buffer memory contents to the E^2PROM.

(f) Before resuming control, check the Q64TC for the following items. If any fault is found, refer to Chapter 8 and take corrective action.
1) The RUN LED is on.
2) The ERR. LED is off.
3) The write error flag (Xn2) is off.
4) The hardware error flag (Xn3) is off.

(g) Since the new module is in a default status, it must be initialized by a sequence program after control resumption.
Before performing initialization, check whether the contents of the initialization program are correct or not.
1) Normal system configuration
The sequence program should perform initialization on the leading edge of Module Ready Flag (X9) of the Q64TC.
When control resumption is executed, Module Ready Flag (X0) turns ON and initialization is performed. (If the sequence program performs initialization only one scan after RUN, initialization is not performed.)
2) When used on remote I/O network
Insert a user device that will execute initialization at any timing (initialization request signal) into the sequence program. After control resumption, turn ON the initialization request signal to perform initialization. (If the sequence program performs initialization only one scan after a data link start of the remote I/O network, initialization is not performed.)

(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" screen, click the [Execution] button to resume control. The FROM/TO instruction for the module resumes.



(b) The "Online module change completed" screen appears.

7.4 Precautions for Online Module Change

The following are the precautions for online module change.

(1) Always perform an online module change in the correct procedure. A failure to do so can cause a malfunction or failure.

(2) If you resume control after setting the prerecorded values to the buffer memory of the new module after an online module change, control cannot be resumed in the same control status since the manipulated values (MV) (buffer memory addresses DH to 10H: Un\G13 to 16) are cleared once at the point when control was stopped.

(3) If an alarm occurred before an online module change, the same alarm will not always occur at the resumption of control. For example, when a standby upper-limit alarm has been set, a standby status will be established and no alarm occur at the resumption of control after an online module change if the alarm occurred before the online module change.

8 TROUBLESHOOTING

8.1 Error Code List

The error code of the Q64TC is stored into address 0 of the buffer memory.
The error code is stored into the lower 3 bits of address 0 and the error-detected buffer memory address into the upper 12 bits.

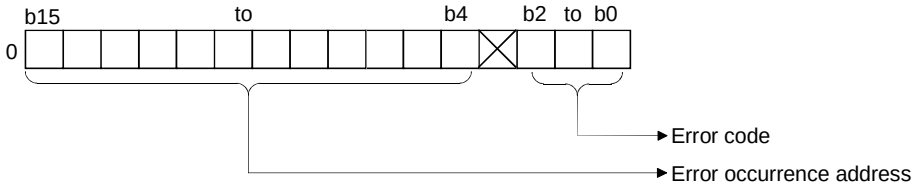


Table 8.1 Error Code List

Error code	Cause	Error-time operation	Corrective action
2	• A value other than 0 was written to the reserved area.	• The written data is held as is. • If the data was written to more than one write area, the buffer address where the error was detected first is retained.	• Make error reset (Yn2 : ON). • Delete the program for performing write to the reserved area.
3	• Write to the area write-enabled in the setting mode only*1 was performed in the operation mode*2.	• The written data is held as is. • If the data was written to more than one write area, the lowest address of the buffer memory where the error was detected is retained.	• Make error rest in the following procedure: 1) Choose the setting mode. 2) Set a correct value. 3) Make error reset (Yn2: ON). • When changing from the operation mode to the setting mode, make sure that the PID continuation flag (A9H) is 0 and turn off Yn1.
4	• Data outside the setting range was written.	• The written data is held as is. • If the temperature, time or % setting is beyond the upper or lower limit value, the upper/lower limit value is used to exercise control. • If the data outside the range was written to more than one write area, the lowest address of the buffer memory where the error was detected is retained.	• Set data within the range.
5	• The setting of the upper/lower output limiter or upper/lower setting limiter is illegal.	• The written data is held as is. • The upper and lower limit values that may be set are used to exercise control. • The error occurrence address is stored into buffer memory address 0. • If the data was written to more than one write area, the lowest address of the buffer memory where the error was detected is retained.	• Make setting so that the upper limit value is greater than the lower limit value.
6	• The set value was changed during default setting registration.	• The written data is ignored. • Any set value cannot be changed until error reset is made. • If another write error occurs, the buffer memory address data does not change.	• After making error reset (Yn2: ON), change the set value.

*1: The following areas are write-enabled in the setting mode only:
- Input range (20H, 40H, 60H, 80H)
- Alert 1 to 4 mode setting (C0H to C3H, D0H to D3H, E0H to E3H, F0H to F3H)

*2: The system is in the operation mode when:
- Yn1 or Xn1 is ON; or
- Yn1 has turned from ON to OFF and the PID continuation flag (A9H) is 1.

*3: If errors occurs in the Warning 1 mode setting (C0H) and Warning 2 mode setting (C1H) for CH1, the lower address number "C0H" is stored in b0 to b15 of the buffer memory address 0.

REMARK

1) The error code "4" is stored if data outside the setting range is written to the input range area or alert mode setting area in the setting mode.
If you switch the setting mode to the operation mode without making error reset, the error code changes to "3".
In this case, perform the error processing of the error code "3".

2) The errors have the following priorities.
If a higher-priority error occurs during occurrence of a lower-priority error, the error code and error occurrence address of the lower-priority error is overwritten by those of the higher-priority error.

[Priority]
6 ← 1 ← 5 ← 2/4
Higher Lower

For the same priority level, the lower error address takes precedence.

8.2 Processing Performed by Q64TC at Error Occurrence

The Q64TC performs processing as explained below if an error occurs in the Q64TC/PLC CPU or when the PLC CPU is switched from RUN to STOP.

Status	Processing			
Control output setting for CPU stop error	CLEAR		HOLD	
PID continuation flag	Stop	Continue	Stop	Continue
When PLC CPU is switched from RUN to STOP	In accordance with stop mode setting	Operation is continued and external output is provided.	In accordance with stop mode setting	Operation is continued and external output is provided.
At PLC CPU stop error occurrence	Operation is stopped and external output is turned off.		In accordance with stop mode setting	Operation is continued and external output is provided.
At Q64TC write error occurrence	In accordance with operation to be performed at error in Table 8.1 Error code list			
At Q64TC hardware error occurrence	Depending on hardware error condition			
During PLC CPU reset	Module itself becomes inoperative and external output is not provided.			

DANGER

- Be extremely careful when setting the PID continuation flag which controls the external output.
- Abnormal output may be provided due to a failure of an output element or its internal circuit.
Install an external monitoring circuit for the output signals which may lead to serious accidents.

8

8.3 If the RUN LED Has Flickered or Turned Off

Check item	Corrective action
Is 5VDC supplied?	• Check the power supply module. • Load the module securely.
Is the sum of current capacities of the modules loaded on the base unit equal to or less than the current capacity of the power supply module?	Make the sum of current capacities of the modules loaded on the base unit equal to or less than the current capacity of the power supply module.
Has a watchdog timer error occurred?	• Reset the PLC CPU or power it on again. • Change the Q64TC.
Is a module change enabled during an online module change?	Refer to Chapter 7 and take corrective action.

8.4 If the ERR. LED Has Turned On or Flickered

(1) If turned on

Check item	Corrective action
Is the cold junction temperature compensation resistor disconnected?	• Connect the cold junction temperature compensation resistor.
—	• Q64TC hardware fault. Please consult your sales representative.

(2) If flickered

Check item	Corrective action
Has a write data error occurred?	• Check the error code list in Section 8.1 and correct the sequence program.

8.5 If the ALM LED Has Turned On or Flickered

(1) If turned on

Check item	Corrective action
Has the alert occurrence flag (XC to XF) turned on?	• Check the buffer memory address 5H to 8H and take action for the alert that occurred.

(2) If flickered

Check item	Corrective action
Is the process value beyond the measured temperature range specified for the input range?	• Change the input range setting to the operating temperature range setting.
Is there any channel where a thermocouple is not connected?	• Set the channel where a thermocouple is not connected as unused to the buffer memory address 3DH, 5DH, 7DH, 9DH.
Has a loop disconnection been detected?	• Check for a load disconnection, external operation device fault, sensor disconnector or the like.

8.6 If the Module Ready Flag (Xn0) Does Not Turn ON

Check item	Corrective action
Has a watchdog timer error occurred?	• Reset the PLC CPU or power it on again. • Change the Q64TC.
Has an error occurred in the PLC?	• Refer to the used PLC CPU User's Manual and take corrective action.

8.7 If the Write Error Flag (Xn2) Has Turned ON

Check item	Corrective action
Has a write data error occurred?	• Check the error code list in Section 8.1 and correct the sequence program.

8.8 If the Hardware Error Flag (Xn3) Has Turned ON

Check item	Corrective action
Is the cold junction temperature compensation resistor disconnected?	• Connect the cold junction temperature compensation resistor.
—	• Q64TC hardware fault. Please consult your sales representative.

8.9 If the Alert Occurrence Flag (XnC to XnF) Has Turned ON

Check item	Corrective action
Is the measured temperature error/alert set value beyond the range?	• Check the buffer memory address 5H to 8H and take action for the alert that occurred.
Is a disconnection detected?	

8.10 Checking the Q64TC Status by System Monitoring of GX Developer

Choosing the detailed information of the Q64TC in system monitoring of GX Developer allows you to check the error codes and LED lit-up states.

(1) Operating GX Developer

[Diagnostics] → [System monitor] → "Select Q64TC" →
Module Detailed Information

(2) Module Detail Information

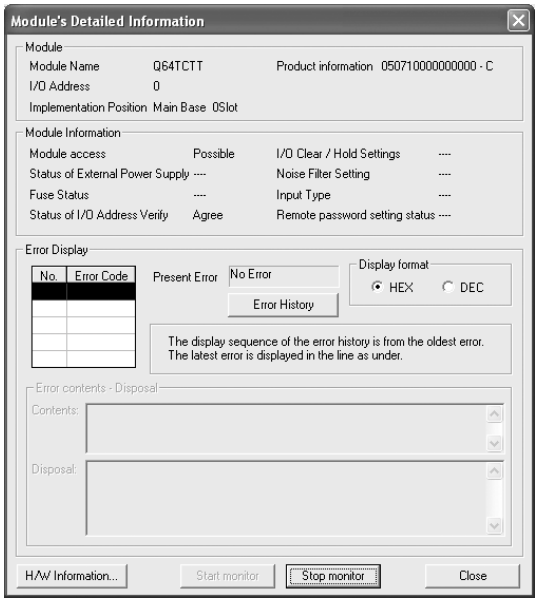
(a) Checking the function version

The function version of the Q64TC is displayed in the product information field.

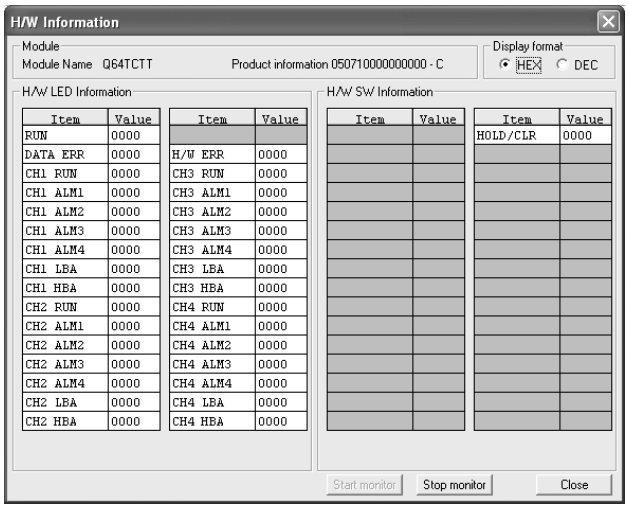
050710000000000-C
Function version

(b) Checking the error code

The error code stored in buffer memory address 19 (Un\G19) of the Q64TC is displayed in the Present Error field.
(When the Error History button is pressed, the contents displayed in the Present Error field are displayed in the No. 1 field.)



(3) H/W Information (When using GX Developer Version 6 or later)



(a) Hardware LED information

The hardware LED information gives the following information.

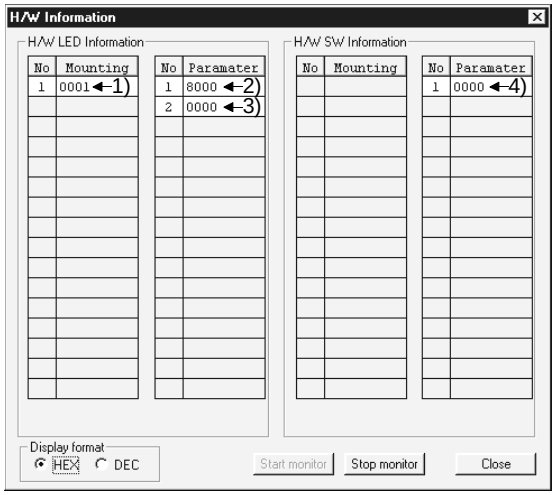
Item	Condition on which value turns to 1	Item	Condition on which value turns to 1
RUN	Same as the one of the actual RUN LED	—	—
DATA ERR	At write data error occurrence	H/W ERR	At hardware error occurrence
CH1 RUN	When CH1 PID control is exercised	CH3 RUN	When CH3 PID control is exercised
CH1 ALM1	When CH1 alert 1 is on	CH3 ALM1	When CH3 alert 1 is on
CH1 ALM2	When CH1 alert 2 is on	CH3 ALM2	When CH3 alert 2 is on
CH1 ALM3	When CH1 alert 3 is on	CH3 ALM3	When CH3 alert 3 is on
CH1 ALM4	When CH1 alert 4 is on	CH3 ALM4	When CH3 alert 4 is on
CH1 LBA	When CH1 loop disconnection is detected	CH3 LBA	When CH3 loop disconnection is detected
CH1 HBA*	When CH1 heater disconnection is detected	CH3 HBA*	When CH3 heater disconnection is detected
CH2 RUN	When CH2 PID control is exercised	CH4RUN	When CH4 PID control is exercised
CH2 ALM1	When CH2 alert 1 is on	CH4 ALM1	When CH4 alert 1 is on
CH2 ALM2	When CH2 alert 2 is on	CH4 ALM2	When CH4 alert 2 is on
CH2 ALM3	When CH2 alert 3 is on	CH4 ALM3	When CH4 alert 3 is on
CH2 ALM4	When CH2 alert 4 is on	CH4 ALM4	When CH4 alert 4 is on
CH2 LBA	When CH2 loop disconnection is detected	CH4 LBA	When CH4 loop disconnection is detected
CH2 HBA*	When CH2 heater disconnection is detected	CH4 HBA*	When CH4 heater disconnection is detected

* Only when the Q64TCTTBW/Q64TCRTBW is used

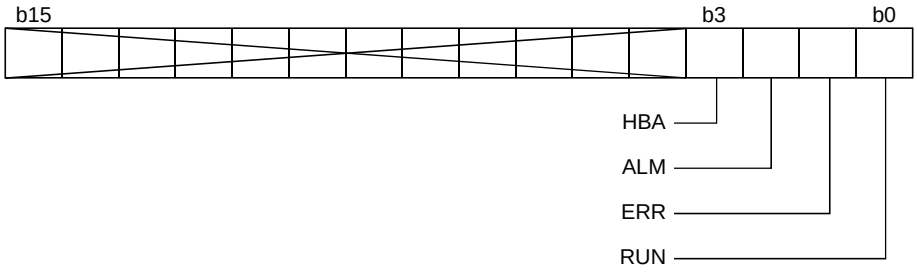
(b) Hardware switch information

Shows the intelligent function module switch 1 setting states.

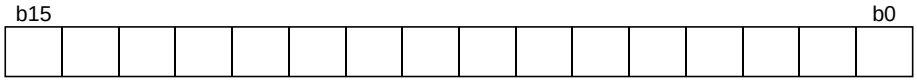
(4) H/W Information (When using GX Developer Version 5 or earlier)



1) Actual LED information



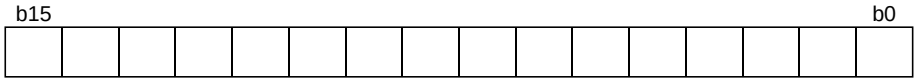
2) LED1 information



bit	Condition on which bit turns on	bit	Condition on which bit turns on
b0	When CH2 heater disconnection is detected*	b8	When CH1 loop disconnection is detected
b1	When CH2 loop disconnection is detected	b9	When CH1 alert 4 is on
b2	When CH2 alert 4 is on	b10	When CH1 alert 3 is on
b3	When CH2 alert 3 is on	b11	When CH1 alert 2 is on
b4	When CH2 alert 2 is on	b12	When CH1 alert 1 is on
b5	When CH2 alert 1 is on	b13	When CH1 PID control is exercised
b6	When CH2 PID control is exercised	b14	At write data error occurrence
b7	When CH1 heater disconnection is detected*	b15	Same as the one of the actual RUN LED

∗ Only when the Q64TCTTBW/Q64TCRTBW is used

3) LED2 information



bit	Condition on which bit turns on	bit	Condition on which bit turns on
b0	When CH4 heater disconnection is detected*	b8	When CH3 loop disconnection is detected
b1	When CH4 loop disconnection is detected	b9	When CH3 alert 4 is on
b2	When CH4 alert 4 is on	b10	When CH3 alert 3 is on
b3	When CH4 alert 3 is on	b11	When CH3 alert 2 is on
b4	When CH4 alert 2 is on	b12	When CH3 alert 1 is on
b5	When CH4 alert 1 is on	b13	When CH3 PID control is exercised
b6	When CH4 PID control is exercised	b14	At hardware error occurrence
b7	When CH3 heater disconnection is detected*	b15	Unused

∗ Only when the Q64TCTTBW/Q64TCRTBW is used

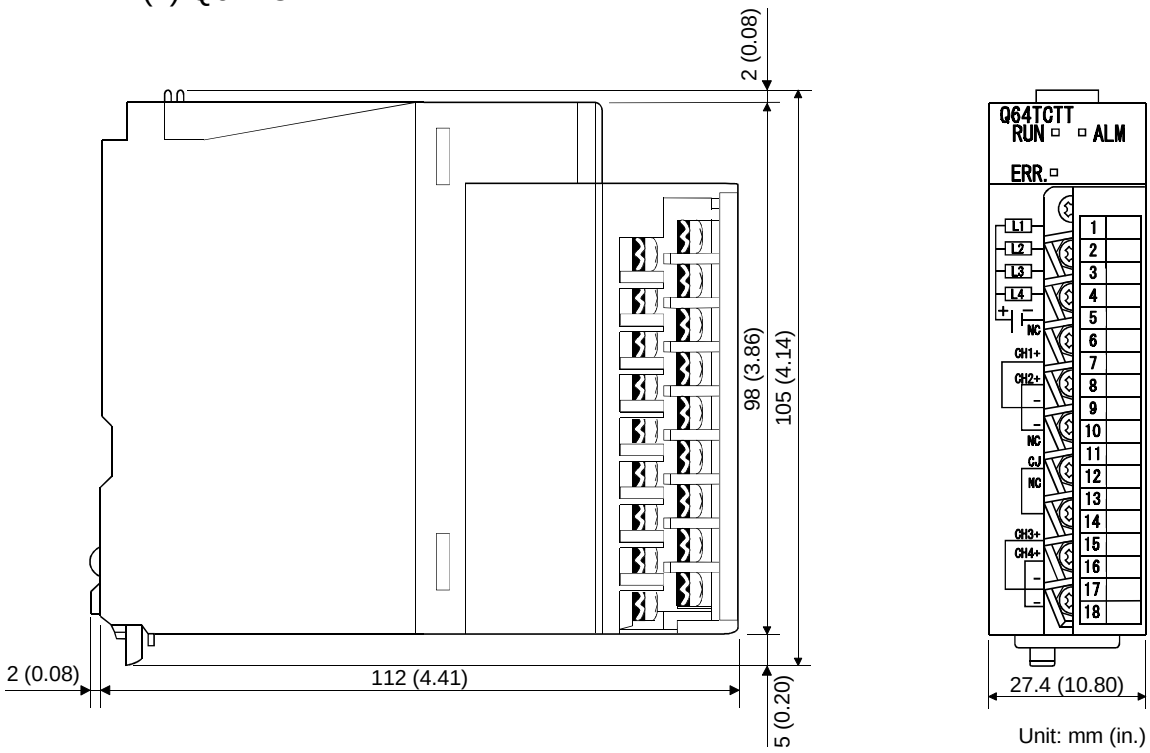
4) Switch information

Shows the intelligent function module switch 1 setting states.

APPENDIX

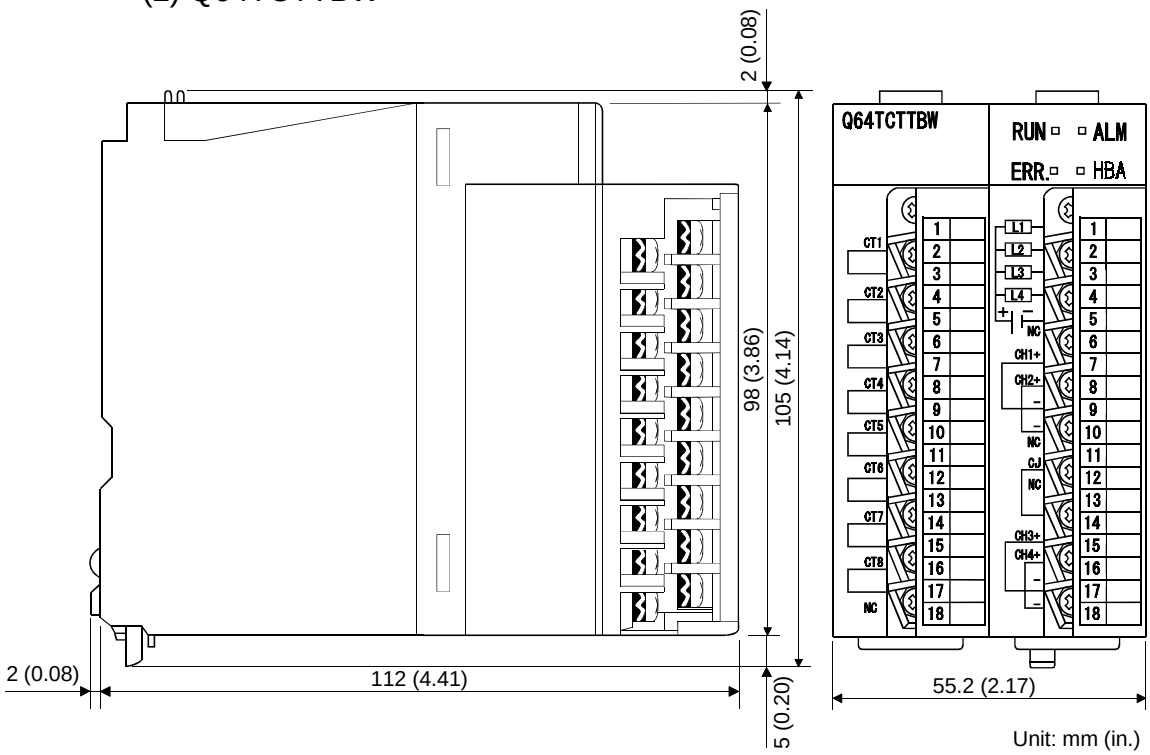
Appendix 1 External Dimension Diagram

(1) Q64TCTT



Unit: mm (in.)

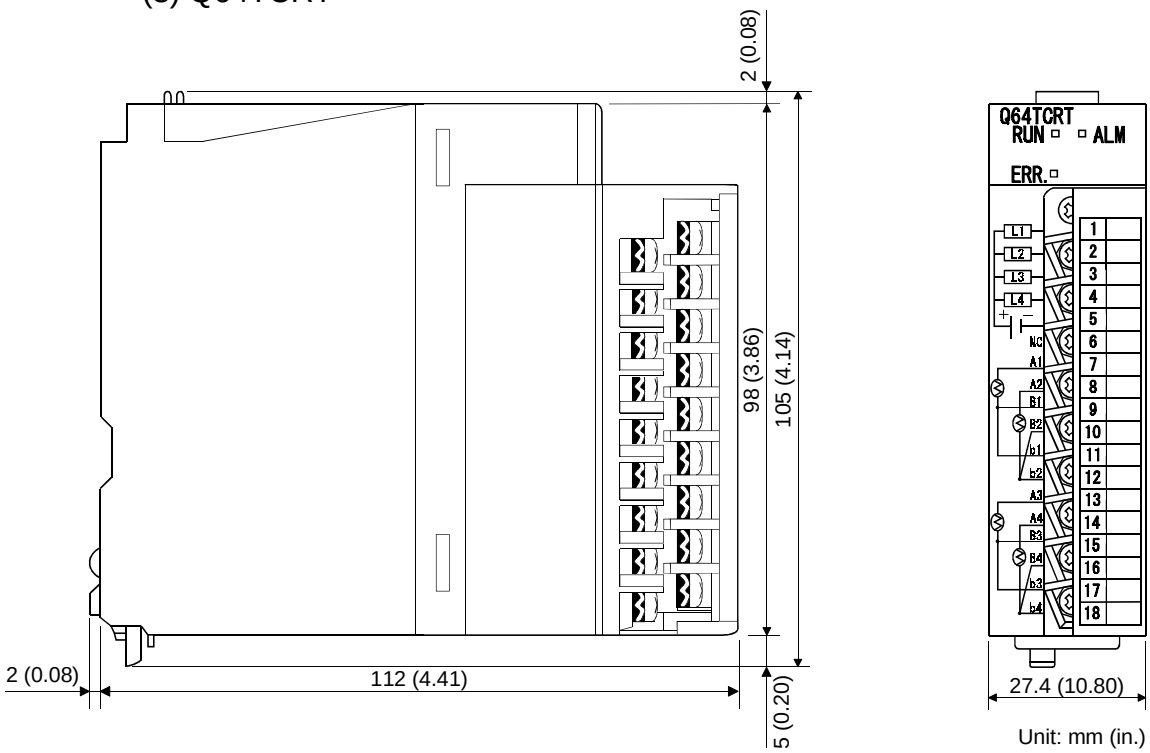
(2) Q64TCTTBW



Unit: mm (in.)

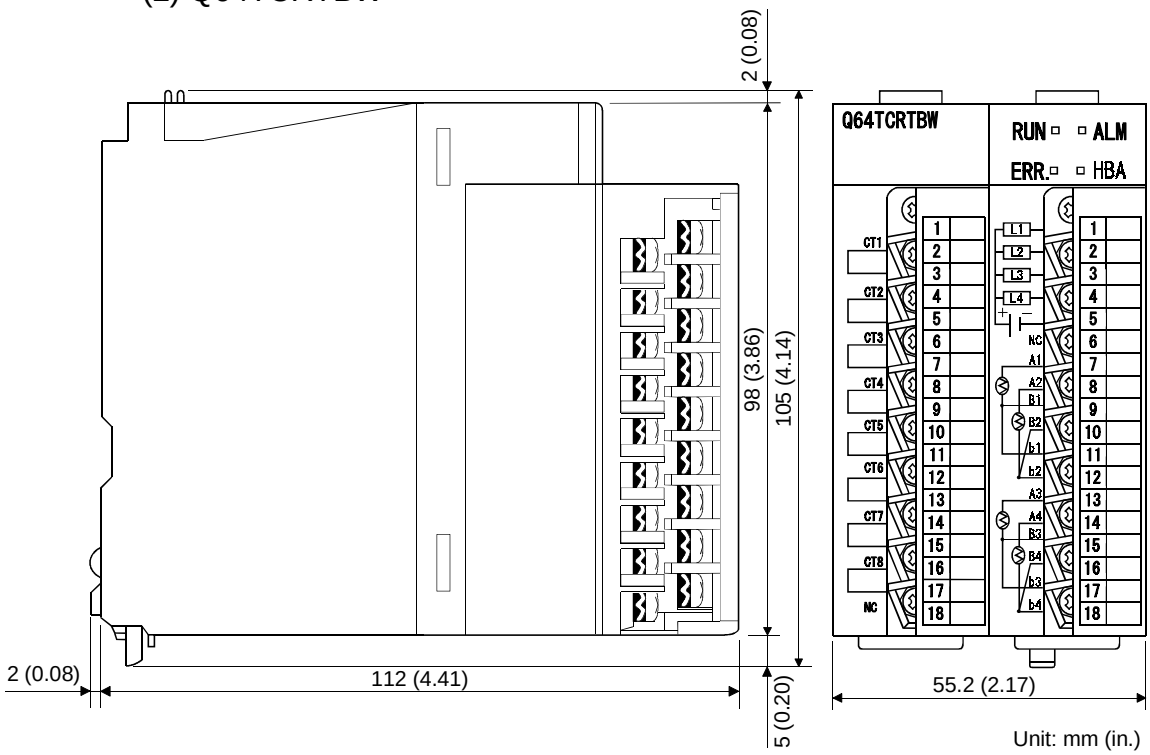
App.

(3) Q64TCRT



Unit: mm (in.)

(2) Q64TCRTBW



Unit: mm (in.)

App.

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MEMO

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WARRANTY

Please confirm the following product warranty details before using this product.

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However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

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The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.
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[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
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2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
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(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
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Temperature Control Module

User's Manual

MODEL	Q64TCTT/RT-U-S-E
MODEL CODE	13JR21
SH(NA)-080121-J(0603)MEE	

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